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ABSTRACT

The Objective-Item Bank presented covers 16 sections of four subject areas in each of four grade levels. The four areas are: Language Arts, Math, Social Studies, and Science. The four grade levels are: Primary, Intermediate, Junior High, and High School. The Objective-Item Bank provides school administrators with an initial starting point for curriculum development and with the instrumentation for program evaluation, and offers a mechanism to assist teachers in stating more specifically the goals of their instructional program. In addition, it provides the means to determine the extent to which the objectives are accomplished. This document presents the Objective Item Bank for high school science. (CK)

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HIGH SCHOOL SCIENCE
BEHAVIORAL OBJECTIVES AND TEST ITEMS

EVALUATION FOR INDIVIDUALIZED INSTRUCTION

A Title III ESEA project
administered by
Downers Grove, Illinois
School District 99

individualized instruction • inservice workshops to improve skills in evaluating new programs • pupil progress •

1400 West Maple Avenue
Downers Grove, Illinois 60515
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	Lang. Arts	Math.	Soc. Stud.	Science
Primary				
Intermediate				
Junior High				
High School				X

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BEHAVIORAL OBJECTIVE – TEST ITEM BANK

What Is It?

And

What Are Its Potential Uses?

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Evaluation for Individualized Instruction Project
AN ESEA TITLE III PROJECT
Administered
by
Downers Grove Public School District 99

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THE OBJECTIVE-ITEM BANK; WHAT IS IT?

BACKGROUND

Ever since the first workshop in 1968, the project has been amassing behavioral objectives and associated test items for ultimate storage in an objective-item bank. More than 5,000 objectives and 20,000 items have been collected. The purpose of this activity is two-fold:

1. To put at the disposal of teachers a comprehensive fund of behavioral objectives to assist them in designing individualized learning programs for their students.

2. To serve teachers with a large supply of quality multiple choice test items intended to measure how far these objectives have been met by their students.

ORGANIZATION OF THE BANK

The bank is organized into 16 sectors defined by all combinations of 4 subject areas and 4 grade levels (see grid below).

Subject Area

	LA	MA	SS	SC
1	11	12	13	14
2	21	22	23	24
3	31	32	33	34
4	41	42	43	44

LA = Language Arts
MA = Math
SS = Social Studies
SC = Science

1 = primary
2 = intermediate
3 = junior high
4 = high school

INTRODUCTION
OF
POSSIBLE USES

Unfortunately, the Objective-Item Bank is often viewed mainly as a source of test items. Although this is an important function, its greatest potential impact lies **not** in the availability of a multitude of test items, but rather in the ability of these items to measure carefully selected educational goals.

The almost frenetic search for test items on the part of some educators has been spurred by the current emphasis on measurement. Some educators have become so enamored with measurement that they seem more interested in obtaining a numerical index than examining what they are really trying to measure. Further, it is not unusual for teachers to speak about a child obtaining a score of 95% on a particular test. Frequently, they encounter considerable difficulty in interpreting the real meaning of a score and are content to just accept its numeral value. A much more important question would seem to be: What are our goals of measurement? Unless we can answer this question precisely, the only real purpose that testing serves is to gather data concerning pupils to facilitate the marking of report cards. This is **not** to say that this function is not legitimate – it is rather to say that such a view of measurement is much too constricting. The goal of measurement should be to **provide feedback both** to the teacher and the child regarding the **success or failure** of the learning experiences in realizing specifically stated objectives.

One of the main strengths of the EII Objective and Item Bank is that all the items are directly tied to specifically stated objectives. Each group of items is designed to measure a specific objective and therefore provides the means whereby the teacher can obtain feedback on the success of the educational program.

It is disheartening to observe so many districts attacking the complex problem of curriculum development independently. One cannot help reflecting on the mammoth duplication of efforts involved. The Objective-Item Bank offers a possible alternative to this duplication. Utilizing its resources, the curriculum committee is provided with some point of departure. The efforts of three hundred teachers participating in the Evaluation Project's workshops and the thoughts of forty districts can be evaluated and utilized. This is **not** to suggest that any set of objectives should be viewed as the "answer" to an individual district's curricular problem but rather the efforts of others offer a convenient point of departure and may serve to stimulate diverse opinions about the direction of curricular thrust within the individual district. The words of Sir Isaac Newton seem appropriate; "If I have seen further, it is by standing upon the shoulder of gaints." The efforts of others, whether we consider them giant-like or pygmyish, do offer a threshold to view the immense, complicated problem of curricular development in better perspective.

The title of an article in a recent educational journal, "If You're Not Sure Where You're Going, You're Liable to End up Someplace Else," succinctly describes a continuing dilemma in our educational system. The vagueness of our goals often promotes the idea that "anything goes." Without a guiding beacon many classrooms become activity centered rather than goal orientated. One educator recently compared the all-too-typical classroom with Henry Ford's observation concerning history. He defined history as, "One damned thing after another." Is this true of the succession of activities within our classrooms? Does the teacher really know the educational purpose of each activity? Perhaps, even more importantly, do the children know the purpose?

The Objective-Item Bank offers a mechanism to assist teachers in stating more specifically the goals of their instructional program and further provides the means to determine the extent to which the objectives are accomplished. The specification of goals assists the teacher in discovering whether favored activities advance learning, or are merely time fillers; whether they get the "materials" across, or are merely perfunctory exercises.

Much discussion has been devoted to the topic of "**why** individualized instruction?" and occasionally some dialogue has even centered on the "**how**". But an even more basic question is one that is often ignored: "Individualize **what?**"

Many school districts mention their individualized programs in reading or mathematics. What is individualized within these programs? Are certain skills definitely identified? Is the practice of pre-testing to determine the child's level of proficiency when he enters the program a guideline?

The Objective-Item Bank has two potential contributions to make to all school districts embarking on or presently engaged in individualized instruction programs. These contributions are: 1. A group of well specified objectives which could form the "what" of the program. 2. A set of items designed to provide information on the degree of mastery of the objective.

SUMMARY

The Objective-Item Bank has four main potential uses.

A. It provides an initial starting point for curriculum development. The existence of many objectives avoids the necessity of each district duplicating the efforts of another. The task of the curriculum committee becomes one of selecting and/or rejecting objectives from the Objective-Item Bank and then supplementing them with objectives developed at the local level. Past-participants of the Evaluation Project workshops would be valuable resource people in this endeavor.

B. It provides the instrumentation for program evaluation. The selection of items from those objectives representative of the main emphases of the local district provides the framework for the evaluation of the stated goals.

C. It provides the means whereby the teacher can become more acutely aware of that which he is seeking to have occur in his classroom and that which he will accept as evidence of its occurrence. Hopefully, as teachers become more aware of their goals, they will share these objectives with children and let the pupils become acutely aware of that which is expected of them, ergo allowing them to seek their own modality of instruction for the realization of the stated goals.

D. It provides the nucleus of an individualized instruction program.

   1. A major obstacle to the institution of effective programs in individualized instruction is the omission of pre-testing. Since each objective in the Bank is accompanied by at least several items, the overcoming of the above mentioned obstacle should be expedited.

   2. The suggested activities could be designed by the local district to accompany the stated objectives and these two components could become part of an independent study program geared to pupil interest and choice. Mastery of the selected objective could be measured by the items accompanying the objective.

NOTES TO USERS:

Even though the objectives and test questions included here have undergone numerous editings and proof readings, it is likely that a small number of errors still exist.

If any user reports an error (an incorrect answer, a misspelled word, etc.), the staff will be pleased to compile an errata sheet and make the necessary corrections for all subsequent printings.

In addition:

1. The number immediately after the statement of each objective represents the number of items measuring attainment of that objective.

2. The IBM 407 we used does not print all characters exactly as they appear on a typewriter; thus,

% is actually (
☐ is actually)
0 is actually ? or !
apostrophes cannot be printed

PHYSICAL SCIENCES

MEASUREMENT

THE STUDENT WILL EXHIBIT HIS ABILITY TO EVALUATE DEFINITIONS USED IN THE LAB BY INDICATING THE ACTUAL MEANING. 202

If we use the surface of the earth as our frame of reference in motion considerations, then the horizontal "straight line" motion parallel to the earth's surface as used in our lab experiments means: 4400583

a. actually a curve everywhere parallel to the earth's surface.
b. a straight line extending tangent to the earth's surface out into space.
*c. in actual practice the horizontal straight line motion is so short that either choice a or b will fit the meaning.
d. we must use the mathematical definition of a straight line.
e. the earth is not a satisfactory frame of reference to use in lab experiments.

Source: Project Physics, ch. 3.6, p. 74.

THE STUDENT WILL IDENTIFY FROM A LIST OF DIFFERENT METRIC UNITS THOSE THAT ARE EQUAL IN VALUE BY SELECTING THE UNIT OF MEASUREMENT THAT IS NOT EQUAL TO THE OTHERS. 130

Which of the following is NOT equal to the others? 4400328

a. 0.0087 g.
b. 8.7×10^{-3} g.
*c. 8.7×10 mg.
d. 8.7×10^{-6} Kg.
e. 8.7×10^{-3} ml. of water

Which of the following is NOT equal to the others? 4400329

a. $\frac{1g}{0.75}$
*b. 7.5×10^{-1} g
c. 1.33 g.
d. 1.330×10^{3} mg.
e. 1.33×10^{-3} Kg.

Which of the following are equal? 1. 1.37 L. 2. 1.37×10^{-3}L. 3. 1.37×10^{3} ml. 4. 137 ml. 5. 1.37×10^{-4} L. 4400330

a. 1 & 2
*b. 2 & 4
c. 2, 3 and 5
d. 4 & 5
e. none of them

Source: Lab Manual Appendix

THE STUDENT WILL SHOW HIS ABILITY TO COMPREHEND THE EFFECTS OF "SCALING" THINGS LARGER OR SMALLER BY PREDICTING OUTCOMES WHEN SCALE CHANGES ARE MADE FOR LIVING ORGANISMS AND REAL OBJECTS. 183

If all the linear dimensions of an office safe were to be made three times larger, its weight would increase by a factor of: 4400547

a. 1.7 times
b. 3.0 times
c. 6.0 times
d. 9.0 times
*e. 27 times

If a gorilla such as "King Kong" of the movies was to be 50 feet tall (ten times normal) and was scaled up equally in each linear dimension, to attain his normal strength to weight ratio his bone and muscle cross section diameters will have to be: 4400548

a. 10 times more
*b. 32 times more
c. 64 times more
d. 100 times more
e. 1000 times more

If each dimension of an aquarium is exactly doubled, its capacity in gallons will increase by a factor of: 4400549

a. 2 times
b. 3 times
c. 4 times
d. 6 times
*e. 8 times

Two similar warm blooded, fur bearing animals of equal strength to weight ratio are found to be in a ratio of 24 to 1 as far as weight is concerned. The approximate ratio of their heights would be closest to: 4400550

a. 2 to 1
*b. 3 to 1
c. 4 to 1
d. 8 to 1
e. 24 to 1

THE STUDENT WILL EXHIBIT HIS ABILITY TO APPLY THE CONCEPT OF NEAREST ORDER OF MAGNITUDE ESTIMATION BY ESTIMATING ORDER OF MAGNITUDE IN A UNIQUE SITUATION. 196

Estimate, to the nearest order of magnitude, the number of ping-pong balls it would take to fill the physics lab if all the furniture were removed. 4400572

a. 10^3 balls
b. 10^5 balls
*c. 10^7 balls
d. 10^9 balls
e. 10^{10} balls

(Note: Ans. is for room 205-Maine East-Smaller lab 10^6 possible)

Estimate, to the nearest order of magnitude, the number of basket balls it would take to fill the physics lab if all the furniture were removed. 4400573

a. 10^3
*b. 10^5
c. 10^7
d. 10^9
e. 10^{10}

(Note: Small lab could be 10^4 balls.)

Source: PSSC physics Part I

THE STUDENT WILL BE ABLE TO SHOW HIS COMPREHENSION OF THE CONCEPTS OF A "FRAME OF REFERENCE" BY SELECTING THE OVERALL DESCRIPTION FROM A GROUP OF IDEAS PRESENTED. 198

A "frame of reference" is: 4400575

a. a rigid, 3-dimensional frame fastened to the lab table.
b. using the speed of light as the speed limit of the universe.
*c. a point of reference from which motion comparisons are made.
d. keeping in mind that everything seems to be in motion.

A "frame of reference" can best be described as: 4400576

a. always being motionless
b. the sun
c. the earth
d. being motionless or moving at constant velocity
*e. being motionless, or moving at uniform velocity, or moving under uniform acceleration.

Source: PSSC Physics Part 3

THE STUDENT WILL APPLY HIS UNDERSTANDING OF DATA MEASUREMENT BY CORRECTLY DETERMINING PROPER UNCERTAINTY IN MEASUREMENTS. 76

A student records the temperature of a beaker of water as 71.236 ± .2° C. The thermometer is calibrated in 1° intervals. This temperature reading is not correct because 4400185

a. the uncertainty is too large.
b. the uncertainty is too small.
*c. the reading has too many figures.
d. the reading has too few figures.
e. of some other reason.

In a newspaper article on population, the population of Illinois was given as 13,486,500 people. The probable uncertainty in this number is 4400186

a. ± 1
b. ± 10
*c. ± 100
d. ± 1,000
e. ± 10,000

USING BASIC MATHEMATIC COMPUTATIONS, THE STUDENT WILL DEMONSTRATE UNDERSTANDING OF THE ABSOLUTE UNCERTAINTY IN A DERIVED QUANTITY BY IDENTIFYING THE MARGIN OF UNCERTAINTY IN HYPOTHETIC SITUATIONS. 77

In a given football game the star half back made the following carries. 4 yards, 13 yards, -2 yards, 26 yards, 6 yards, and 3 yards. Assuming there is an uncertainty of ± ½ yard, the best measure of this player's production is 4400187

a. 50 ± ½ yards
b. 50 ± 2 yards
*c. 50 ± 3 yards
d. 50 ± 25 yards
e. none of the above

You wish to determine the gas mileage on your new car. You drive 300.0 ± .1 miles and use 20.0 ± .1 gallons of gas. The best representation of your gas mileage is 4400188

a. 15.0 ± .2 mi/gal
b. 15 ± 1 mi/gal
c. 15.00 ± .01 mi/gal
*d. 15.00 ± .08 mi/gal
e. 15.00 ± .1 mi/gal

THE STUDENT WILL BE ABLE TO SHOW HIS UNDERSTANDING OF THE UNCERTAINTY OF A DERIVED QUANTITY BY SOLVING PROBLEMS INVOLVING MULTIPLICATION AND/OR DIVISION, AND INDICATING THE UNCERTAINTY. 250

A rock has a mass of 36.35 ± 0.01g and occupies 15.6 ± 0.2 ml. The density of the rock showing uncertainty is 4400665

*a. 2.30 ± 0.02 g/ml
b. 2.30 ± 0.2 g/ml
c. 2.30 ± 0.5 g/ml
d. 2.30 ± 0.05 g/ml
e. none of these

A gas shows a pressure of 2.45 ± 0.01 atmospheres in a container volume is 10.0 ± 0.5ℓ . PV for the gas including uncertainty is 4400666

a. 24.5 ± 0.5ℓ
b. 24.5 ± 0.7ℓ
c. 24.5 ± 1.0ℓ
*d. 24.5 ± 1.2ℓ
e. 24.5 ± 1.5ℓ

Source: Raytheon Chemistry, p. 15-16 .

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE RELATIONSHIP OF UNCERTAINTY TO DIVISIONS ON A MEASURING DEVICE BY STATING THE VALUE OF UNCERTAINTY INHERENT IN VARIOUS DEVICES OF MEASUREMENT GIVEN THE SIZE OF THE DIVISIONS. 251

A 100 ml graduated cylinder is marked in 2 ml divisions. Which value is the best value for uncertainty of measurement. 4400667

a. ± 0.1 ml
b. ± 0.5 ml
*c. ± 1.0 ml
d. ± 1.5 ml
e. ± 2.0 ml

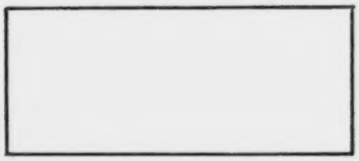
A 50 ml gas buret is found to have an uncertainty of measurement of ± 0.5 ml. The buret is marked in divisions of 4400668

a. 0.5 ml
*b. 1.0 ml
c. 2.0 ml
d. 2.5 ml
e. 5.0 ml

Source: Raytheon Chemistry, p. 13.

THE STUDENT CAN SHOW HIS UNDERSTANDING OF THE METRIC SYSTEM BY FINDING THE LINEAR MEASUREMENTS OF A GIVEN RECTANGLE. 166

Directions: Use a metric rule to measure the rectangle below and identify the dimensions asked for in the following questions.



The length in cm. of the above rectangle is 4400482

*a. 5
b. 50
c. 500
d. .5
e. 5000

The width in mm. of the above rectangle is 4400483

* a. 21
b. 23
c. 2.1
d. 2.3
e. 20

MODELS AND PROBLEM SOLVING

GIVEN THE NECESSARY INFORMATION, THE STUDENT WILL APPLY HIS UNDERSTANDING OF THE FACTOR LABEL METHOD OF PROBLEM SOLVING BY CORRECTLY SETTING UP A PROBLEM USING THE METHOD. 57

Given: 1 Kg = 2.2 lbs., 1 Kg = 1000g., 4400154

1 ton = 2000 lbs., 1 mole of Na = 23g of Na,

1 mole contains 6×10^{23} Na atoms:

How many Na atoms in 5 tons of Nametal? (Give the correct set up - use factor label method. Do not work the problems.)

ON THE BASIS OF GIVEN ASSUMPTIONS, THE STUDENT WILL ANALYZE A SCIENTIFIC MODEL BY SELECTING THE PROPERTIES THE MODEL WILL EXHIBIT. 71

Assume a model for a gas in which the molecules are attached to each other by infinitely long elastic bonds. The gas then behaves like a piece of foam rubber. That is, when pressure is exerted the gas contracts and when pressure is removed the gas expands. Which of the following properties would NOT expect this gas to exhibit? 4400171

a. The gas will contract on cooling.
b. The gas will expand on heating.
c. Increase pressure when more gas is added.
d. Expand to fill a container.
*e. Contract on cooling to form a liquid.

There is an empirical (theoretical) expression of the behavior of gases at normal conditions, it is called the ideal gas law. This law uses the particle model of gases with the following assumptions: 4400172

a. The particles have negligible size when compared to the space around them.
b. The particles do not lose energy on collision with other particles or the container.
*c. The particles have negligible attraction for each other.

Using these assumptions, a mathematical expression has been derived that does describe the behavior of gases at normal conditions. In each of the following indicate by letter which assumption or assumptions accounts for the property of a gas given. Let letter d mean both a and b and letter e mean both b and c. 4400173

e Under normal conditions a gas will not condense to a liquid.

a Gases are easily condensed.

a The volume of a mole of any gas is the same under the same conditions.

e A balloon will stay inflated indefinitely if no gas leaks out.

b A gas will not settle in a container.

c A gas will expand to fill the container.

THE STUDENT SHALL BE ABLE TO RECALL THE BASIC ACTIVITIES OF SCIENCE AND STATE THEM IN LOGICAL ORDER. 245

The scientist will: 4400658

1. communicate his findings to others
2. gather information by observations
3. search for regularities
4. question the regularities

The logical order in which the scientist will perform these activities is:

a. 4, 2, 3, 1
*b. 2, 3, 4, 1
c. 3, 4, 2, 1
d. 4, 3, 2, 1
e. 2, 4, 3, 1

Source: Raytheon—Chemistry, p. 1 and 2.

THE STUDENT WILL EXHIBIT HIS ABILITY TO EVALUATE GOOD THEORY CHARACTERISTICS BY IDENTIFYING NON-VALID STATEMENTS. 210

Below are some characteristics that can be applied to a theory. Select the one that is the least valid. A theory: 4400593

a. should summarize and not conflict with a body of tested information.
*b. should not deal with facts, but only allow for prediction of outcomes.
c. should permit predictions of new observations made naturally or arranged in the laboratory.
d. should be consistent with other theories.
e. is easier to formulate from many facts than from very few.

Source: Project Physics, ch. 8.19, p. 113.

THE STUDENT SHOULD BE ABLE TO DISTINGUISH BETWEEN OBSERVATION AND INTERPRETATION BY IDENTIFYING STATEMENTS AS ONE OR THE OTHER. 242

Identify the statement below which is not a valid observation, but an interpretation in describing a burning candle. 4400652

a. The candle is translucent.
b. The candle is cylinderical.
c. The candle flame is hot.
*d. The candle consumes oxygen.
e. The candle flame is yellow.

Identify the interpretation from the statements below which describes a girl walking in the school corridor. 4400653

a. The girl is approximately 5 ft. tall.
b. The girl is wearing a brown dress.
c. The girl is walking with a boy.
d. The girl has blond hair.
*e. The girl has a beautiful face.

Source: Raytheon—Chemistry, p. -.

THE STUDENT WILL BE ABLE TO ANALYZE A LIST OF OBSERVATIONS BY IDENTIFYING REGULARITIES WHICH ARE PRESENT. 243

We are all familiar with bicycles. Listed below are statements from which you will pick the statement which is not a regularity. 4400654

a. all bicycles have two wheels
b. all bicycles have a steering mechanism
c. all bicycles are made mainly of metal
*d. all bicycles have one seat
e. all bicycles will go foreward

There is one regularity among the description items listed below for soft drinks. 4400655

a. bottles
*b. liquid
c. flavor
d. size
e. carbonated

Source: Raytheon--Chemistry, p. 3-4.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO DRAW INFERENCES FROM FACTS BY SELECTING STATEMENTS THAT ARE SUPPORTIVE OF A GIVEN BODY OF INFORMATION. 78

A small boy from rural India, while on a sight-seeing trip to the U.S.A., becomes locked in a supermarket for a long holiday weekend. Realizing his dilemma, he begins to search for food. To avoid collecting useless items the boy made a list. 4400189

Things to eat	Things not to eat
corn flakes	vinegar
raisins	coffee
milk	ammonia
vanilla ice cream	

On his next trip through the store he took 16 lbs. of detergent which was to last him the rest of the weekend. Therefore, the boy made the following conclusion: Things that are good to eat

a. are cold
b. are light in color
c. have strong odors
d. are solid
*e. come in boxes

Observe the following table. 4400190

Gas	Color	Solubility in Water	Color Change in Litmus
chlorine	greenish-yellow	low	none
nitrogen dioxide	reddish-brown	low	none
ammonia	colorless	high	red → blue
hydrogen	colorless	low	none
hydrogen chloride	colorless	high	blue → red
nitric oxide	colorless	low	none
oxygen	colorless	low	none

An unknown gas is yellow in color and changes the color of litmus from red to blue. The unknown gas most probably has

a. high solubility because it is colored.
*b. high solubility because it changes the color of litmus.
c. low solubility because it is colored.
d. low solubility because it changes the color of litmus.
e. no basis for judgement.

GIVEN A DESCRIPTION OF AN EXPERIMENT AND A SET OF HYPOTHESES CORRELATED TO IT, THE STUDENT WILL APPLY THAT INFORMATION BY SELECTING THE MOST APPROPRIATE VERIFYING PROCEDURE. 87

Directions: Dry gases X and Y are introduced into a flask and the flask sealed. After 3 seconds, $\frac{1}{2}$ of the X cannot be detected. Using only this information, consider each hypothesis below. For each hypothesis, select which experiment will give a positive test of the hypothesis.

Hypothesis: X & Y are in equilibrium with gaseous XY $(X + Y \rightleftarrows XY)$. Which experiment would you use? 4400206

a. add a catalyst.
b. increase temperature
c. wait 3 more seconds and test for X again
*d. add more Y
e. add more X

Hypothesis: X decomposes as in radioactive decay. Which experiment would you use? 4400207

a. Add catalyst
b. Increase temperature
*c. Wait 3 more seconds and test for X again
d. Add more Y
e. Add more X

Hypothesis: X reacts with the flask. Which experiment would you use? 4400208

a. Add a catalyst
b. Increase temperature
c. Wait 3 more seconds and test for X again
d. Add more Y
*e. Add more X

THE STUDENT WILL BE ABLE TO ANALYZE EXPERIMENTAL INFORMATION BY SELECTING THE PROPER ASSUMPTION THAT WAS MADE. 91

An experimenter attempted to determine the value of the equilibrium constant for the following system. 4400216

$$\underset{\text{(Blue)}}{A^{+2}_{(aq)}} + \underset{\text{(Yellow)}}{B^{-}_{(aq)}} \rightleftarrows \underset{\text{(Green)}}{AB^{+1}_{(aq)}} = (aq)$$

By using a large excess of $A^{+2}_{(aq)}$ the experimenter assumed that all of the $B^{-}_{(aq)}$ was consumed and therefore was able to know the concentration of $AB^{+}_{(aq)}$ in the standard tube. The other trials were compared to this standard tube and the concentration of $AB^{+}_{(aq)}$ determined by ratio. What implicit assumption was incorrectly made by this experimenter?

a. B^{-} was not completely consumed in the standard tube.
b. A^{+2} was used in excess in the standard tube.
c. The concentration of $AB^{+}_{(aq)}$ was constant in the standard tube.
*d. The color is due only to the concentration of $AB^{+}_{(aq)}$ in the standard tube.
e. The concentration of $AB^{+}_{(aq)}$ varies with the concentration of $A^{+2}_{(aq)}$

THE STUDENT WILL ANALYZE A SERIES OF RELATIONSHIPS BY SELECTING THE WORD OR WORDS THAT CORRECTLY COMPLETES THE GIVEN ANALOGY. 145

Directions: Fill in the blanks.

Graduate is to liters as balance is to ________. 4400385

a. mm
b. gas meas tube
c. celsius
*d. grams
e. ml

Aluminum is to copper chloride as copper is to ________. 4400386

a. iron
b. copper sulfate
c. mercury
d. sodium chloride
*e. silver nitrate

If there is a pressure increase with the volume unchanged, then there must be temperature ________. 4400387

*a. increase
b. decrease
c. remain same
d. celsius
e. degrees

Mass is to grams as volume is to ________. 4400388

*a. ml
b. mm
c. feet
d. cm
e. none of these

If a gas sample is in a cylinder with a moveable piston and it is heated there will be an increase in ________. 4400389

*a. liters
b. pressure
c. grams
d. mm
e. balance

Ice is to degrees celsius as volume ________ is to mm of Hg. 4400390

*a. ml
b. remaining same
c. decrease
d. increase
e. no effect

$\frac{\text{Grams}}{\text{ml}}$ = mass per ________. 4400391

a. mm
*b. volume
c. molar mass
d. balance
e. cm

$\frac{\text{gm}}{\text{L}}$ $\frac{\text{Moles}}{\text{L}}$ = ________. 4400392

*a. $\frac{\text{g}}{\text{Mole}}$
b. actual mass
c. Moles/g
d. Liter
e. none of these

$\frac{\text{cm}^3}{\text{gm}} = \frac{\text{L}}{?}$ 4400393

a. gm
b. molar mass
c. volume
d. 10^2 gm
*e. 10^3 g.

mm is to meter as cosmic rays are to ________. 4400394

a. xrays
b. cathode rays
*c. visible rays
d. none of above
e. radio waves

THE STUDENT CAN THINK DEDUCTIVELY BY SHOWING THAT FACTS AND UNKNOWNS CAN BE RECOGNIZED. 148

There are six balls weighing six grams, only four of which are red. Each red ball weighs 1 gram. Each white ball weighs 0.5 g. Each green one weighs 0.33 g. Each blue one weighs 1.5 grams.

How many red balls are there? 4400405

a. 1
*b. 4
c. 6
d. none
e. none of above

How many green ones? 4400406

a. 1
b. 3
c. 4
*d. none
e. none of above

How many white ones? 4400407

*a. 1
b. 2
c. 3
d. none
e. none of above

How many grams do 1 blue and 2 green weigh? 4400408

a. 1.5
b. 1.83
*c. 2.16
c. 3
e. none of above

What is the ratio of the weight of a blue ball compared to that of a white ball? 4400409

a. 1/3
b. 1
c. 2
*d. 3
e. can not tell

What percent difference is there in the weights of a red ball and a blue one compared to the red? 4400410

a. 33%
*b. 50%
c. 100%
d. 2%
e. can not tell

How many green balls would be equivalent in weight to 4 red balls? 4400411

a. 3
b. 4
c. 6
*d. 12
e. none of above

One green ball is equivalent to how many blue ones? 4400412

a. 1/6
b. 1/5
c. 1/3
d. 1/2
*e. none of above

If the six balls weighed 7.5 g and if there were 3 red balls, what color might the others be? 4400413

a. red
b. white
c. white and green
d. blue and white
*e. none of the above

What is the product of the weight of the blue, green and white balls? 4400414

*a. .25
b. .5
c. 2.5
d. 5
e. none of these

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO ANALYZE A SELECTION FOR STATED AND UNSTATED ASSUMPTIONS BY SELECTING STATEMENTS THAT DEPEND ON STATED OR UNSTATED ASSUMPTIONS. 186

The following passage was written by Lucretius:
"As a further indication that all particles of matter are on the move, 1) Remember that the universe is bottomless: 2) there is no place where the atoms could come to rest. 3) As I have already shown by various arguments and proved conclusively, 4) space is without end or limit and spreads out immeasureably in all directions alike."

From the above paragraph, select the numbered statement(s) which depend on stated assumptions. 4400554

a. 1 and 2
b. 1 and 3
c. 1 and 4
d. 2 and 3
*e. 1, 2 and 4

From the above paragraph, which statement(s) imply an unstated assumption? 4400555

a. 1
b. 2
*c. 3
d. 4
e. 1, 2, and 4

Source: Project Physics Prologue, p. 3, text 5.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO RECOGNIZE AN UNSTATED ASSUMPTION BY SELECTING ONE FROM A STATEMENT BY PLATO. 208

Plato, an early Greek philosppher, stated that: 4400591
"The stars-eternal, divine, unchanging beings, move uniformly around the earth, as we observe, in that most perfect of all paths, the endless circle." Identify from the choices below, the statement that represents an unstated assumption.

a. stars are "living" entities
b. perfection means circular motion
c. the sun stands still
*d. the earth is the center of the universe
e. the stars always remain the same

Source: Project Physics, ch. 5.4, p. 12.

THE STUDENT WILL DISPLAY HIS ABILITY TO ANALYZE A DESCRIPTION OF MILLIKANS OIL DROP EXPERIMENT FOR THE FACTS THAT ARE RELEVANT AND FACTS THAT ARE NOT RELEVANT BY CORRECTLY IDENTIFYING THE NONRELEVANT PHRASES. 187

In the Millikan oil drop experiment the following facts emerged: 4400556

1. An oil droplet falls with constant velocity when driven by gravity alone.
2. A force twice that of gravity drives the particle just twice as fast as gravity alone.
3. The oil droplets may have an excess of one or more elementary charges.
4. The speeds of the observed droplets seemed to be multiples of a speed covered by a small force unit.
5. Some droplets fell faster, other droplets were observed to move upwards at various rates.

Select the numbered choice that states the fact which made it possible for Millikans to conclude that charge came in a unit package.

a. 1
b. 2
c. 3
*d. 4
e. 5

Source: PSSC Physics, Part 3.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO LOCATE THE CENTRAL THE CENTRAL IDEA OF EARLY SCIENTISTS BY CHOOSING FROM SELECTED QUOTES THE MAIN OBJECTIVE. 203

Galileo is quoted as stating: "We pass now to naturally accelerated motion, such as that generally experienced by heavy falling bodies... We have decided to consider the phenomena of bodies falling with an acceleration such as actually occurs in nature and the essential features of observed accelerated motions." 4400584

From the paragraph above, choose one of the statements below which best indicates Galileo's aim:

a. to present a definition
*b. to state an assumption
c. to deduce a prediction from a hypothesis
d. to experimentally test the prediction

Galileo further wrote: "Finally, in the investigations of naturally accelerated motions we were led, by the hand as it were, in following the habit and custom of nature herself, in all her various other processes, to employ only those means which are most common, simple and easy....." 4400585

From the paragraph above, choose one of the statements below which best indicates Galileo's aim:

a. to present a definition
*b. to state an assumption
c. to deduce a prediction from a hypothesis
d. to experimentally test a prediction

Source: Project Physics, ch. 2.5, p. 47-48.

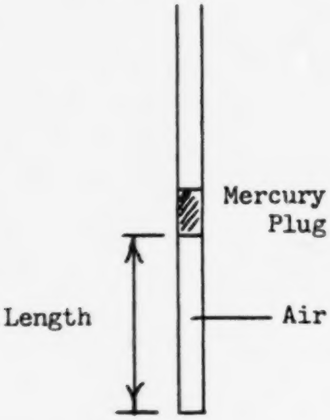
Aristotle said: "A given weight moves (falls) a given distance in a given time; a weight which is as great and more moves the same distance in less time, the times being in inverse proportion to the weights." 4400586

From the above paragraph, Aristotle is simply inferring that:

a. a freely falling body accelerates toward the earth.
b. all falling bodies accelerate at the same rate.
c. falling bodies are hindered by air resistance.
*d. heavy falling bodies accelerate faster than light ones.
e. all falling bodies uniformly accelerate toward the earth.

CHARTS AND GRAPHS

THE STUDENT WILL DEMONSTRATE AN ABILITY TO GRAPH NUMERICAL DATA BY DETERMINING THE ABSOLUTE ZERO FROM A SET OF VOLUME-TEMPERATURE DATA. 4



The length of a trapped air column is measured at different temperatures. The Thermometer used is calibrated in frisby degrees. 4400012

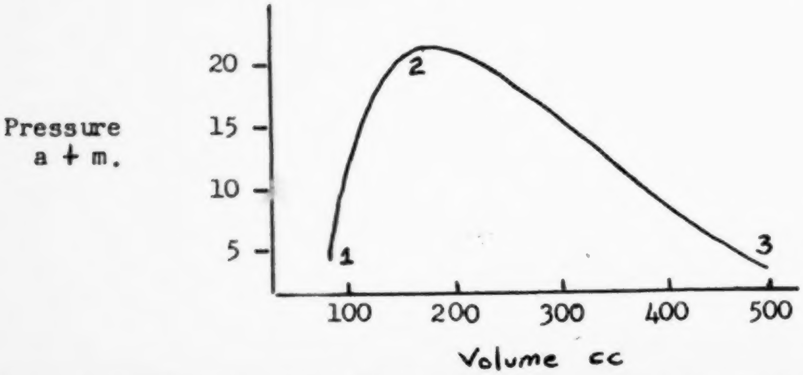
Length, mm	Temperature, frisby degrees
7.2	240
8.8	260
10.4	280
12.0	300

Plot this data on the graph paper provided with your test. What is the absolute zero on the frisby scale?

*a. +150
b. 0
c. -273
d. -459

Source: Experiments and Principles, pages 56-57.

THE STUDENT WILL BE ABLE TO INTERPRET GRAPHS SHOWING CHANGES IN THE STATE OF GASEOUS SYSTEMS BY SELECTING INFORMATION SHOWN IN THE GRAPH NECESSARY TO SOLVE A GIVEN PROBLEM. 5



The graph to the left represents changes occurring in the cylinder of a gasoline engine during the power stroke.

The compression ratio of this engine would be about 4400013

a. 4:1
*b. 10:1
c. 20:1
d. Impossible to determine from the graph

Source: Chemistry: Experiments and principles, pages 57-59.

During which portion of this graph is the gasoline burning? 4400014

a. Point 1 only
*b. Region 1 to 2
c. Point 2 only
d. Region 2 and 3

At what point on the graph is temperature highest? 4400015

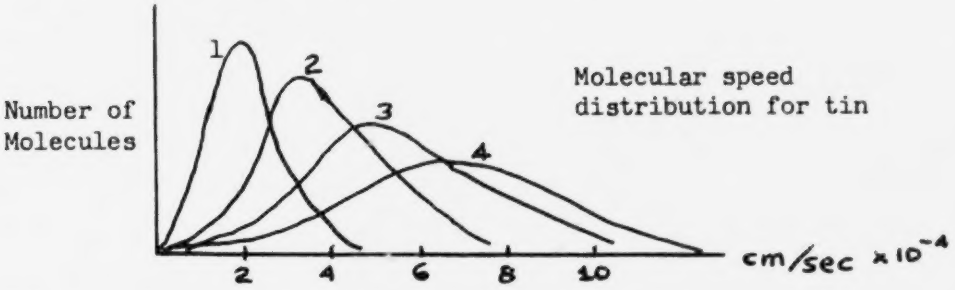
a. Point 1
*b. Point 2
c. Point 3
d. Impossible to determine

During which portion of this graph does the piston move furthest? 4400016

a. Point 1 only
b. Region 1 to 2
c. Point 2 only
*d. Region 2 to 3

Source: Chemistry: Experiments and Principles, pages 57-59.

THE STUDENT WILL BE ABLE TO INTERPRET GRAPHS SHOWING MOLECULAR VELOCITY DISTRIBUTIONS BY SELECTING REQUIRED INFORMATION GIVEN IN THE GRAPH. 6



Which of these graphs corresponds to the lowest temperature? 4400017

*a. 1
b. 2
c. 3
d. 4

Which of the following statements best describes the molecular speed distribution for a given temperature? 4400018

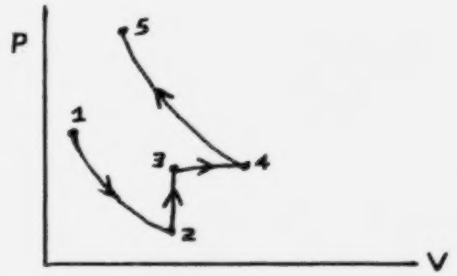
*a. Most molecules move at intermediate speeds; a few move very fast and a few move very slow.
b. There is a highest speed above which molecules never move.
c. Molecules have an equal chance of moving at any speed.
d. The average molecular speed is also the most frequently encountered speed.

If one obtains molecular speed distributions for equal numbers of aluminum and tin atoms at the same temperature, how would the curves compare? 4400019

a. The two curves would be identical.
b. The peak of the aluminum curve would be higher than the peak of the tin curve.
*c. The peak of the aluminum curve would lie to the right of the peak of the tin curve.
d. The aluminum curve would be higher than the tin curve at all speeds.

Chemistry: Experiments and Principles, pages 61–65.

THE STUDENT WILL BE ABLE TO INTERPRET GRAPHS SHOWING CHANGES IN THE STATE OF GASEOUS SYSTEMS BY SELECTING REQUIRED INFORMATION PRESCRIBED IN THE GRAPH. 10



A fixed amount of gas is enclosed in a cylinder with a movable piston. The temperature of the gas can be controlled. A series of changes are recorded on the graph.

During which change is the piston locked in place? 4400028

a. 1-2
*b. 2-3
c. 3-4
d. 4-5

Which of the changes is (are) most likely to be isothermal? 4400029

a. 2-3 only
b. 3-4 only
c. 2-3 and 3-4
*d. 1-2 and 4-5

During which change is volume decreasing? 4400030

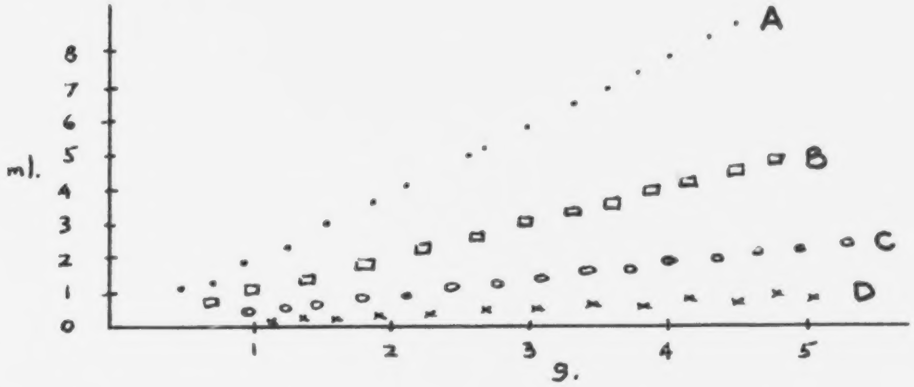
a. 1-2
b. 2-3
c. 3-4
*d. 4-5

At which point is the temperature of the gas highest? 4400031

a. 1
b. 2
c. 3
*d. 4

Source: Experiments and Principles, pages 57-59

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO INTERPRET CHARTS BY MAKING PREDICTIONS BASED ON THE DATA PRESENTED IN THE CHARTS. 137



Different objects were measured for volume and mass. It is hypothesized that all objects labeled have the same metal composition.

What is the density of A? 4400349

a. 5
b. 3
c. 2
d. 1.1
*e. 0.5

What is the density of B? 4400350

a. 5
b. 3
c. 2
*d. 1.1
e. 0.5

What is the density of C? 4400351

a. 5
b. 3
*c. 2
d. 1.1
e. 0.5

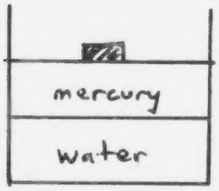
What is the density of D? 4400352

*a. 5
b. 3
c. 2
d. 1.1
e. 0.5

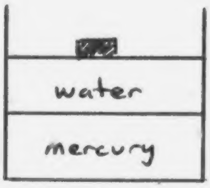
Source: Raytheon Chemstudy Chapter 1.

If mercury and water were poured into a beaker and each solid substance was dropped into the beaker 1 at a time, what would be observed using the densities of substances above.

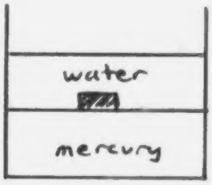
DIAGRAMS OF OBSERVATIONS


mercury
water

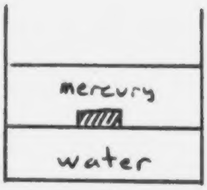
a


water
mercury

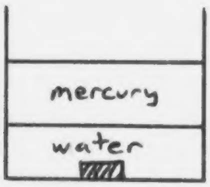
b


water
mercury

c


mercury
water

d


mercury
water

e

A is the solid. Which diagram shows what would be observed? 4400353

*b

B is the solid. Which diagram shows what would be observed? 4400354

*c

C is the solid. Which diagram shows what would be observed? 4400355

*c

D is the solid. Which diagram shows what would be observed? 4400356

*c

MECHANICS

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO COMPREHEND THE NATURE OF VECTOR QUANTITIES BY THE SELECTION OF VECTOR PROPERTIES AND/OR THEIR DEFINITIONS. 190

From the following list, select the one that is NOT a vector quantity: 4400560

a. force
*b. mass
c. displacement
d. acceleration
e. velocity

A vector quantity is best illustrated by which of the following? 4400561

a. a line segment of given length
b. an arrowheaded line of certain direction
c. something that shows direction
d. something that shows size
*e. something that has both magnitude and direction involved

Source: Project Physics, Ch. 3.2 pp. 66-67.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF THE CALCULATIONS INVOLVED IN DETERMINING THE DENSITY OF A SOLID BY SELECTING CORRECTLY CALCULATED ANSWERS FOR GIVEN PROBLEMS USING THE PRINCIPLE OF THE EFFECT OF BUOYANCY IN A LIQUID. 135

An irregularly shaped rock has a mass of 25 g. when weighed in air. It has a mass of 18.5 g. when weighed in water. Its density in g./ml. is 4400340

a. 1.35
b. 2.85
c. 3.25
*d. 3.85
e. 6.15

Expt. 4 in Lab. Manual

A metallic object weighed in air has a mass of 10.9g. It displaced 0.2 ml. of mercury. What is the mass of the metal object weighed in mercury? 4400341

a. 2g.
b. 3.8g.
c. 6.9g.
*d. 7.3g.
e. 1.35 x 10g.

Page 6 Expt. 1 - 1

Of the following, the liquid with the greatest buoyant effect is 4400342

a. air
b. carbon tetrachloride
*c. Mercury
d. aqueous salt solution
e. water

Source: Raytheon Chem. Study, Chap. 1.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO APPLY HIS KNOWLEDGE OF SITUATIONS INVOLVING MASS, WEIGHT, AND GRAVITY BY PREDICTING THE EFFECTS MOON CONDITIONS WOULD HAVE ON MASS, WEIGHT, AND GRAVITY. 194

On the moon, where gravity is 1/6 that of the earth, which of the following does NOT change? 4400568

*a. mass
b. weight
c. period of a pendulum
d. acceleration of gravity
e. escape velocity

When a golfer hits the ball on a lunar golf course, the distance the ball travels over the ground will be greater because: 4400569

a. the ball can be hit harder
b. the ball will travel faster
c. the ball is lighter
*d. the ball reaches a greater height
e. the ball has the same mass

THE STUDENT WILL SHOW HIS ABILITY TO COMPREHEND THE TERM WEIGHTLESS AS APPLIED TO EARTH INFLUENCED OBJECTS BY SELECTION OF THE APPROPRIATE MEANING FROM STATED CONDITIONS. 199

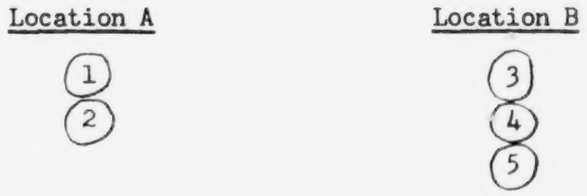
The term "weightless" as applied to an astronaut in a perfect orbit about the earth actually means that: 4400577

a. his mass is now zero.
b. his weight is now zero.
c. the earth is no longer exerting a force on him.
*d. he and the capsule are accelerating earthward at rate "g".
e. he could easily float off into deep space.

In a strictly definitive sense, a person would not be truly weightless unless: 4400578

*a. he is located in a tunnel at the exact center of gravity of the earth.
b. he is free-falling prior to opening his parachute.
c. he is in orbit around the moon.
d. he is in a falling elevator whose cable has broken.
e. he is flying through a loop the loop in an airplane.

THE STUDENT WILL EXHIBIT HIS ABILITY TO APPLY THE UNIVERSAL LAW OF GRAVITY BY PREDICTING THE CHANGE IN FORCE WHEN A CHANGE IS MADE IN THE MASS. 214



Five identical spheres are arranged as shown above at a distance of one meter from their centers. The ratio of gravitational attraction of the masses at "A" have for those at "B" compared with the attraction those at B" have for those at "A" is 4400598

*a. 1 : 1
b. 2 : 3
c. 3 : 2
d. 4 : 9
e. 3 : 5

Suppose in the preceding problem, we move sphere number 2 over to location "B", how will the gravitational force between them now compare with the force of the original configuration? 4400599

a. 1 : 1
b. 1 : 4
c. 4 : 1
*d. 2 : 3
e. 1 : 2

If, in the arrangement in item #1 we were to add sphere #6 to those at location "A", and move them 2 meters apart, what is the result? 4400600

a. The amount of force between the locations has increased by $\frac{3}{2}$.
b. The amount of force between the locations is the same as before.
c. The amount of force between them has increased by $\frac{9}{4}$.
*d. The amount of force between them now is approximately $\frac{1}{3}$.
e. The amount of force between them now is exactly $\frac{1}{2}$.

Source: Project Physics, ch. 8.7, p. 92-95.

THE STUDENT WILL EXHIBIT HIS ABILITY TO APPLY THE LAW OF GRAVITY BY PREDICTING THE EFFECT ON "G" OF CHANGES IN MASS OR DISTANCE. 215

Assume that Pluto has the same mass as the earth, but just 1/3 its radius. How will "g" on Pluto compare with "g" on the Earth? 4400601

a. the same
b. 1/3 as large
c. 3 times as large
*d. 9 times as large
e. 27 times as large

If, on the earth, we were to tunnel to within 1/3 R_e of the center, "g" here compared to its surface value is 4400602

a. 1/3 as large
b. 1/6 as large
c. 1/9 as large
*d. 1/27 as large
e. the same

Source: Project Physics, ch. 8.8, p. 95-96.

THE STUDENT WILL BE ABLE TO SHOW HIS KNOWLEDGE OF NEWTONS LAW OF UNIVERSAL GRAVITATION BY IDENTIFYING ITS LIMITATIONS. 218

Why is there an attraction between all bodies in the universe? 4400606

a. Because the bodies all have mass.
b. Because the bodies are all some given distance apart.
c. Because the universal law of gravity exists.
d. Because there is a value of "g" in the universal law of gravity.
*e. It is still a puzzle to our scientists today.

Source: Project Physics, Ch. 8.6, p. 90.

THE STUDENT WILL SHOW HIS ABILITY TO RECOGNIZE STATEMENTS SUPPORTING THE LAW OF CONSERVATION OF MASS BY SELECTING THEM FROM A LISTING OF STATEMENTS. 258

Select the statement which is not supported by the Law of Conservation of mass 4400682

a. atoms are conserved
b. moles are not conserved
*c. molecules are conserved
d. matter is conserved
e. mass of reactants equals mass of products

Which of the following stated equations is consistant with the law of conservation of mass 4400683

a. $2H_2 + O_2 \longrightarrow H_2O$
b. $CaO + H_2O \longrightarrow Ca(OH)_3$
*c. $2Na + 2H_2O \longrightarrow 2NaOH + H_2$
d. $Cu + O_2 \longrightarrow CuO$
e. none of these

Source: Raytheon Chemistry, p. 44.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO EVALUATE EVIDENCE CONCERNING THE EARTHS SHAPE BY INDICATING A CONCLUSION WHICH IS SUPPORTED BY A GIVEN PIECE OF EVIDENCE. 171

Directions: For the following evaluate the evidence by choosing the corresponding letter of the conclusion supported by it.

a. The earth is shaped like a disc.
b. The earth could be shaped like a disc.
c. The earth is not shaped like a disc.
d. The earth is not shaped like a sphere.
e. The earth is shaped like a sphere.

_c_ 1. A ship sailing out to sea appears to sink below the horizon. 4400498

_c_ 2. The surface of a large unobstructed smooth area appears slightly curved. 4400499

_b_ 3. The earth casts a curved shadow on the moon. 4400500

_b_ 4. The altitude of the stars Polaris and Sigma Octantis does not change when traveling east or west. 4400501

_e_ 5. The altitude of the stars Polaris and Sigma Octantis changes when traveling north or south. 4400502

Source: ESCP, Investigating Earth Science, Chapter 3, Houghton Mifflin Co.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO EVALUATE EVIDENCE CONCERNING THE SHAPE OF A GIVEN PLANET BY INDICATING A CONCLUSION WHICH IS SUPPORTED BY A GIVEN PIECE OF EVIDENCE. 172

Directions: The following problems are concerned with the shape of planet X. Evaluate the evidence by choosing the corresponding letter of the conclusion supported by it.

a. Planet X is shaped like a disc.
b. Planet X is not shaped like a disc.
c. Planet X is not shaped like a sphere.
d. Planet X could be shaped like a sphere.
e. Planet X is shaped like a sphere.

c 1. A ship sailing out to sea appears to get smaller and eventually fades from sight. 4400503

c 2. The surface of a large unobstructed smooth area appears level. 4400504

d 3. Planet X casts a curved shadow on its moon. 4400505

a 4. The altitude of any star remains unchanged when traveling toward it or away from it. 4400506

d 5. The altitude of any star remains unchanged when traveling in a perpendicular direction to the left or right of it. 4400507

Source: ESCP, *Investigating Earth Science*, Chapter 3, Houghton Mifflin Co.

THE STUDENT WILL BE ABLE TO RECALL THE RELATIONSHIP BETWEEN THE FLUIDITY AND UNIFORMITY OF COMPOSITION OF THE LITHOSPHERE, HYDROSPHERE AND ATMOSPHERE. 173

Indicate the factor which results in the composition of the atmosphere and hydrosphere being more uniform than that of the lithosphere. 4400508

*a. The lithosphere is less fluid than the other two.
b. The lithosphere is composed of more substances.
c. The lithosphere has a higher density.
d. The lithosphere is a solid.
e. The lithosphere is not as old as the other two.

Indicate which of the following statements can be attributed to the fact that the composition of the lithosphere is not as uniform as either the atmosphere or hydrosphere. 4400509

a. The lithosphere has a higher density than the atmosphere and hydrosphere.
*b. The atmosphere and hydrosphere are more fluid than the lithosphere.
c. The variety of elements in the lithosphere is greater than the atmosphere and hydrosphere.
d. The hydrosphere floats on the lithosphere.
e. The lithosphere is encompossed by the atmosphere.

Source: ESCP, Investigating Earth Science, Chapter 3, Houghton Mifflin Co.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO EVALUATE EVIDENCE CONCERNING THE EARTH'S MOTIONS BY INDICATING A CONCLUSION WHICH IS SUPPORTED BY A GIVEN PIECE OF EVIDENCE. 175

Directions: For the following, evaluate the evidence by choosing the corresponding letter of the conclusion supported by it.

a. The sun revolves around the earth.
b. The sun could revolve around the earth.
c. The sun does not revolve around the earth.
d. The earth revolves around the sun.
e. The earth rotates on an axis.

_d_ The color of a star appears to change on a six month cycle. 4400520

_b_ The sun appears to rise in the east and set in the west. 4400521

_e_ The inscribed plane created by a pendulum dangling from a free frictionless swivel appears to rotate. 4400522

_c_ The star constellation in the winter sky are different from those in the summer sky. 4400523

Source: ESCP, Investigating Earth Science, Chap. 4, Houghton MIfflin Co.

THE STUDENT WILL DEMONSTRATE AN ABILITY TO EVALUATE A SERIES STATEMENT WITH RESPECT TO A SET OF GIVEN DATA ON DIMENSIONS OF THE EARTH BY INDICATING THOSE WHICH ARE SUPPORTED BY THE DATA. 176

Directions: Using the table indicate your evaluation of each statement by choosing the corresponding degree of validity.

Choices:
a. The statement is valid according to information the table.
b. The statement is valid based on information other than that given in the table.
c. The statement is invalid according to information in the table.
d. The statement is invalid based on information other than that given in the table.
e. The statement could be valid according to information given in the table.

Dimensions of the Earth

Dimensions	Kilometers	Miles
Equatorial Radius	6,378	3,963
Polar Radius	6,357	3,950
Equatorial Circumference	40,076	24,902
Polar Circumference	40,008	24,860
Length of a Degree of a Great Circle	111.32	69.17

_a_ The equatorial diameter is greater than the polar diameter. 4400524

_a_ A point 10 degrees south of the equator is 6,917 miles from the north pole. 4400525

_c_ A ship will have to sail west 222.64 kilometers to reach New York if it is 2 degrees east of it. 4400526

_e_ The difference in the amount of heat received at the equator as opposed to the poles explains their difference in size. 4400527 _c_ The longest direct distance between two opposite points on the equator passes through one of the poles. 4400528

_b_ The earth revolves on an axis which passes through its poles. 4400529

_d_ The altitude of the star Polaris is 91° for a point 69.17 miles south of the equator. 4400530

Source: ESCP, Investigating Earth Science, chapt. 3

THE STUDENT WILL DISPLAY KNOWLEDGE OF PTOLEMYS WORK BY SELECTING THE ASSUMPTION PTOLEMY DID NOT MAKE FROM A LIST. 206

Select one from the following choices which is not an assumption from Ptolemy's theory of planetary motions. 4400589

a. that the earth is spherical
b. that the earth is at the center of the heavenly sphere
*c. that the earth moves about the sun
d. that the earth's size is negligible compared to the heavenly spheres.
e. that the heaven is spherical in form and rotates around the earth once a day.

Source: Project Physics, Ch. 5.7, p. 24

THE STUDENT WILL DISPLAY HIS UNDERSTANDING OF THE REASONS WHY PTOLEMYS THEORY WAS ACCEPTED FOR SO LONG BY CHOOSING A FALSE ONE FROM A LIST OF VALID REASONS. 207

Ptolemy's theory for "planetary motions" was used for at least 1500 years for many good reasons. From the list of reasons below, select the one that is not valid for the above. 4400590

a. It predicted fairly accurately the positions of the sun, moon, and planets.
*b. It was completely successful in explaining the complex retograde motion of planets such as Mars.
c. It did not predict that the fixed stars should show a parallactic shift.
d. It had common sense appeal to all who saw the sun, moon, planets, and stars moving around them.
e. It agreed with the comforting assumption that we live on an immovable earth at the center of the universe.

Source: Project Physics, ch. 5.7, p. 24.

THE STUDENT WILL EXHIBIT HIS ABILITY TO RECOGNIZE THE REASONING OF COPERNICUS BY IDENTIFYING HIS ASSUMPTIONS. 205

A Polish astronomer, Copernicus, brought out his own system for explaining the motions of the heavenly bodies. Select the one, from the following, which is not an assumption made by Copernicus. 4400588

*a. the earth is at the center of the heavenly sphere
b. there is no one center of all the celestial circles or spheres
c. the center of the earth is not the center of the universe but only of gravitation and of the lunar sphere
d. all the spheres revolve about the sun and therefore the sun is the center of the universe
e. the earth performs a complete rotation on its fixed poles in a daily motion, while the stars remain unchanged.

Source: Project Physics, ch. 6.1, p. 29

THE STUDENT WILL EXHIBIT HIS ABILITY TO EVALUATE THE CONTRIBUTIONS OF COPERNICUS BY THE SELECTION OF HIS GREATEST CONTRIBUTION. 209

From the list below, which one was most probably the greatest contribution of Copernicus to the problem of heavenly motions? 4400592

*a. that there was a possibility of a new explanation for astronomical observations
b. that the sun was the center of the universe about which everything, including the earth, revolved
c. that the stars should show a parallactic shift
d. that it was possible for life to exist on the other planets
e. that the sun centered system explained the always elusive retrograde motions of the planets.

Source: Project Physics, ch. 6.5, p. 39

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO APPLY KINEMATICS PRINCIPLES BY IDENTIFYING OPTIMUM USE OF ROCKET STAGES. 204

A small toy 2 stage rocket is fired; to gain its maximum altitude, when should the 2nd stage be fired? 4400587

*a. immediately after the 1st stage burns out and is jettisoned
b. only after the whole package reaches the top of the trajectory as a result of the 1st stage firing
c. immediately after 1st stage burns out, but before jettisoning that stage
d. only after the 2nd stage already separated from the heavy 1st stage reaches the top of its trajectory

IN THE STUDY OF MOTION, THE STUDENT WILL BE ABLE TO SHOW HIS ABILITY TO RECALL THE DIFFERENCES BETWEEN THE CONCEPTS OF KINEMATICS AND DYNAMICS BY SELECTING THE PROPERTIES INVOLVED IN THE CONCEPTS. 195

From the following, choose the item that is NOT involved in the concept of kinematics. 4400570

*a. mass
b. time
c. position
d. speed
e. acceleration

From the following, choose the item that is involved in kinematics, but NOT in dynamics. 4400571

a. mass
b. force
*c. speed
d. momentum
e. kinetic energy

Source: Project Physics, Ch. 3.1 p. 65.

THE STUDENT WILL SHOW HIS UNDERSTANDING OF AIR RESISTANCE IN FREELY FALLING BODIES BY IDENTIFYING VALID STATEMENTS PERTAINING TO SUCH SITUATIONS. 192

When a parachutist reaches terminal velocity in his fall, which condition below is NOT correct? 4400564

a. The force of gravitational attraction equals his weight.
*b. He is accelerating at the rate of 9.8 $m./sec.^2$
c. The force of air resistance equals his weight.
d. His weight is expressed by $F=mg$

An object released from a horizontally moving airplane contrasted with one dropped from a tethered observation balloon at the same altitude will: 4400565

a. always hit the ground first
b. always hit the ground last
c. hit the ground at the same spot
*d. hit the ground in the same time
e. hit the ground with the same terminal velocity

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO EVALUATE THE SCIENTIFIC SOUNDNESS OF STATEMENTS ABOUT FIELDS AND FORCES BY INDICATING EACH STATEMENT'S DEGREE OF SCIENTIFIC ACCURACY. 174

Direction: For the following express your evaluation of the statement by choosing the corresponding letter of the correct stage.

a. belief stage
b. authoritative opinion stage
c. observation stage
d. predicting stage
e. controlled experiment stage

_e_ The temperature of the air mass in a room which has been heated to 73°F is composed of more than one field. 4400510

_a_ Changes in the location of the earth's magnetic poles are a result of changes in the earth's central core. 4400511

_b_ For any two objects in the universe, the force of attraction between them is proportional to their product. 4400512

_e_ The force of earth's gravity is affected by it's shape rotation and surface irregularities. 4400513 d The gravitational force on the surface of Saturn is about 9.3 newtons. 4400514

c Sun spots produce solar winds which strike the earth causing magnetic storms and auroras. 4400515

a The gravitational force between two objects is a result of the energy with in the objects. 4400516

a The gravitational force between two objects is a result of the lack of energy in a shadow zone between the objects. 4400517

d The weight of a 200 lb. space probe on Mars. 4400518

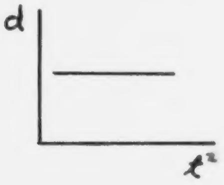
c The earth's magnetic field changes constantly. 4400519

Source: ESCP Investigating Earth Science, Chap. 5, Houghton Mifflin Co.

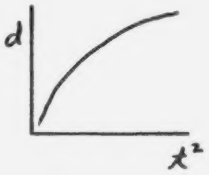
THE STUDENT WILL DEMONSTRATE HIS ABILITY TO COMPREHEND UNIFORM ACCELERATED MOTION BY IDENTIFYING THE APPROPRIATE GRAPH FORMS REPRESENTING THAT MOTION. 184

A steel bearing rolls down an inclined plane metal track and you plot distance moved versus time squared intervals. Your graph will be closest to which of the following? 4400551

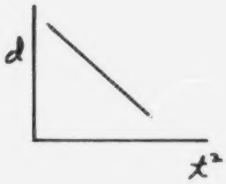
a.



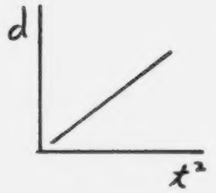
c.



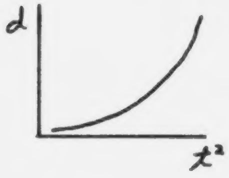
e.



*b.

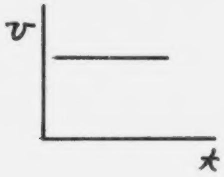


d.

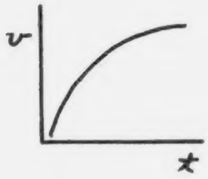


If an object is falling toward the earth, neglecting air friction, its graph of velocity versus time would be: 4400552

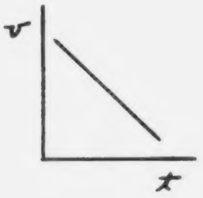
a.



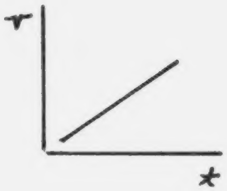
c.



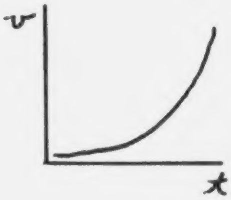
e.



*b.



d.



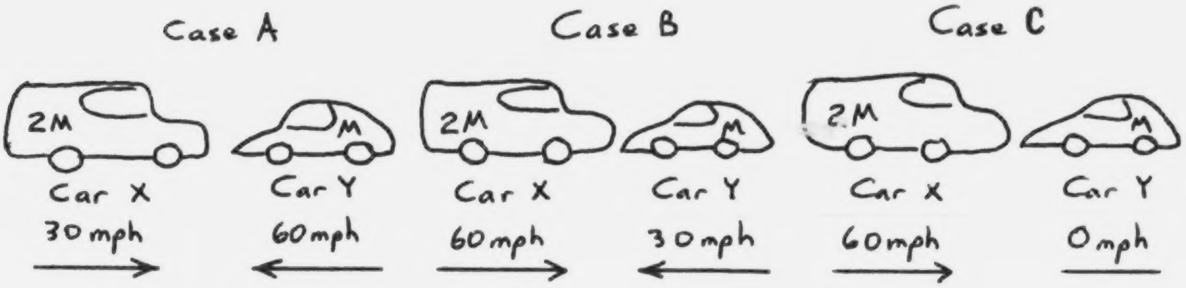
THE STUDENT WILL EXHIBIT HIS ABILITY TO EVALUATE A SITUATION INVOLVING CHANGE OF MOMENTUM BY IDENTIFYING NON-VALID REASONING IN A HYPOTHETICAL SITUATION. 185

Commander Corny is just shy of reaching orbital velocity in his rocket the X-10 as it runs out of fuel. He can get a little more final velocity by throwing out some cabbages from the rear of the rocket. What is NOT a valid reason for throwing them out all at once rather than one at a time? 4400553

a. One at a time means the mass of the remaining cabbages must be accelerated along with the rocket.
b. Commander Corny must act quickly before the rocket begins free-fall back to earth.
*c. The total change of momentum is greater throwing them out singly.
d. He does less work by throwing them out all at once.

THE STUDENT WILL SHOW HIS ABILITY TO APPLY HIS KNOWLEDGE OF CONSERVATION OF MOMENTUM IN A PRACTICAL SITUATION BY PREDICTING THE EFFECTS OF A COLLISION. 189

Directions: The cars below with relative masses "M" indicated are all involved in head-on collisions. All occupants are firmly seat-belted in place. On the basis of whip lash injury only, pick the choice below where the occupants would be in least danger.



*a. car X in all three cases 4400559
b. car Y in all three cases
c. all equally dangerous
d. car X in case "B" and "C"
e. only car Y in case "C"

Source: PSSC Physics, part 3

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO RECALL THE DEFINITION OF "WORK" IN PHYSICS BY IDENTIFYING ITS CHARACTERISTICS. 193

Work in the physical sense, is best illustrated by which of the following? 4400566

a. Carrying a suitcase some horizontal distance.
b. Jogging the half-mile.
*c. Leisurely ascending the stairs to the 3rd floor.
d. Doing the 100 yd. dash
e. All of the above.

Work is best measured among the following by: 4400567

a. The amount of effort expended.
b. The weight of the object times the distance moved.
*c. The weight of the object times the vertical height moved.
d. The force times its vertical component.
e. All of the above.

THE STUDENT WILL EXHIBIT HIS ABILITY TO ANALYZE NEWTONS CONTRIBUTIONS BY BEING ABLE TO IDENTIFY STATEMENTS THAT DO NOT REFLECT HIS INFLUENCE. 213

Which one of the statements listed below, is not an influence of Newton's work? 4400597

a. That "g" should be constant at a particular place on earth.
b. That "g" should vary at different locations from the earth's center.
c. That at the earth's surface the weight of an object is related to its mass.
d. That Kepler's three laws hold, and are interrelated.
*e. That "g" can be used universally, for example on the moon.

Source: Project Physics, ch. 8.7 p. 110.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO COMPREHEND NEWTON'S FIRST LAW BY SELECTING THE INSIGHTS IT PROVIDES. 197

From the following choices, select the one that best illustrates the insights of Newton's first law. 4400574

a. It defines the concept of inertia.
b. It does not distinguish between objects at rest or in motion.
c. It requires the concept of frames of reference.
d. It is a general, universal law.
*e. All of the above illustrate insights of Newton's first law

Source: Project Physics, Ch. 3.5 pp. 73-74

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO COMPREHEND THE VECTOR NATURE OF NEWTON'S SECOND LAW BY IDENTIFYING VALID STATEMENTS ABOUT ITS APPLICATION. 188

A dry ice puck is at rest on a glass table top and a constant force is applied. Which of the following best describes the result? 4400557

a. It travels equal distances in equal times.
b. Its average speed is the final speed.
*c. It accelerates uniformly in the direction of the force.
d. It accelerates at an ever increasing rate.

When an object is in uniform circular motion, its change of velocity vector is such that at any instant it is not: 4400558

*a. in the direction of the motion
b. in the direction of the centripetal force
c. directed toward the center of the circular motion
d. always of the same magnitude
e. constantly changing

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO APPLY NEWTON'S LAW BY PREDICTING THE EFFECT ON F, M, OR A AS A CHANGE IS MADE IN THE OTHER VARIABLES. 201

If a horizontal force F causes a mass M to accelerate at rate A horizontally, and mass M weighs F in the earth's gravitational field, then mass M will free-fall initially at rate: 4400581

a. 1/2 A
*b. A
c. 2 A
d. 32 A
e. 9.8 A

If a horizontal force F causes a mass M to accelerate at rate A horizontally, then mass 2M will accelerate horizontally at rate: 4400582

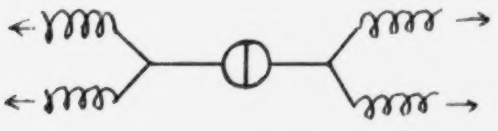
*a. 1/2 A
b. A
c. 2 A
d. 32 A
e. 9.8 A

Source: Project Physics, ch. 3.7, p. 75-76

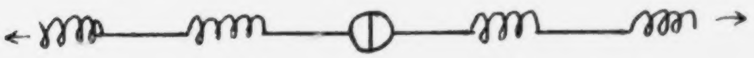
THE STUDENT WILL EXHIBIT HIS ABILITY TO ANALYZE VARIOUS FORCE ARRANGEMENTS IN TERMS OF NEWTON'S 3rd LAW FOR THE MOST EFFECT, BY CHOOSING THE ONE WHERE THE MOST OR LEAST FORCE IS EXERTED FROM A GIVEN NUMBER OF SERIES-PARALLEL ARRANGEMENTS OF FORCE PACKAGES. 200

A student in a laboratory wishes to repeat the experiment conducted by Otto Von Guericke in Magdeburg, Germany. There, horses could not separate the 2 close fitting hemispheres once the space between them was evacuated. 4400579
If the student used springs of identical properties instead of horses, which of the following arrangements of springs would be most likely to separate the two hemispheres.

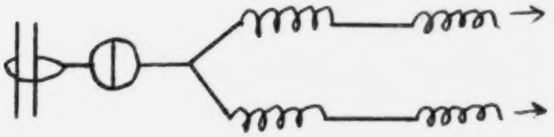
a.



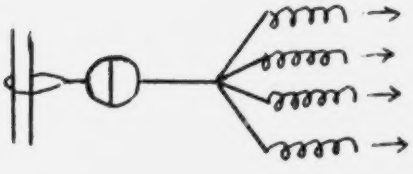
b.



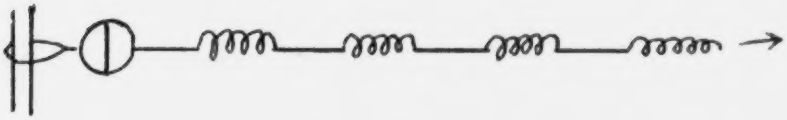
c.



*d.



e.



Using the choices of the question above for arrangements which of the following illustrates the least force exerted on the sphere to pull the halves apart. 4400580

- a. a only
- b. b only
- c. c only
- d. a and b
- *e. b and e

THE STUDENT WILL BE ABLE TO APPLY THE RELATIONSHIP OF PRESSURE AND AREA, DEPTH AND DENSITY BY SELECTING THE RELATIVE PRESSURES IN UNFAMILIAR SITUATIONS. 72

Directions: For each of the following, select the situation which exerts more pressure. If the pressure is the same in both cases, select response c.

a. 200 lb. man, shoe size 12. 4400174
*b. 200 lb. man, shoe size 9.
c. pressure is equal.

a. a dam 200 feet high and $\frac{1}{2}$ mile long. 4400175
b. a dam 200 feet high and 1 mile long.
*c. pressure is equal.

a. a woman in flat shoes. 4400176
*b. the same woman in high heels.
c. pressure is equal.

*a. 100 ml. of mercury in a 250 ml beaker. 4400177
b. 100 ml. of water in a 250 ml beaker.
c. pressure is equal

THE STUDENT WILL BE ABLE TO ANALYZE THE REGULARITY FOUND IN A SET OF DATA AND APPLY IT TO CALCULATIONS THAT DETERMINE PRESSURE CHANGE FROM A GIVEN TEMPERATURE BY SELECTING THE FORMULA THAT CORRECTLY STATES THE REGULARITY CHANGE. 73

Analyze the following hypothetical table to find the regularity.

Pressure (atm)	Temperature
1.00	100°
1.20	120°
1.40	140°
1.60	160°
1.80	180°
2.00	200°

Use this regularity to determine the pressure on a different amount of gas if its original pressure was 1.50 at a temperature of 137° and the temperature is changed to 155°. 4400178

a. $\frac{1.50\text{ atm} \times 137^\circ}{155^\circ}$

*b. $\frac{155^\circ \times 1.50\text{ atm}}{137^\circ}$

c. $\frac{155^\circ}{1.50\text{ atm} \times 137^\circ}$

d. $\frac{1.50\text{ atm}}{155^\circ \times 137^\circ}$

e. none of the above

THE STUDENT CAN APPLY HIS KNOWLEDGE OF GAS AND WATER PRESSURE AND THE HUMAN BODY BY IDENTIFYING A STATEMENT OF CAUSE AND THE PREVENTATIVE PROCEDURE WHICH IS MOST CLOSELY RELATED TO A GIVEN CRITICAL INCIDENT. 128

You and your friend have just completed a course in scuba diving. You each know something about water and air pressure from the scuba course and your physics class. Both of you realize that there are hazards to scuba diving and that certain biomedical problems may arise if you fail to follow certain principles involving the use of your equipment or if you become frightened, confused, and panic.

Following is a series of incidents relating to scuba diving which occurred one summer because the individual scuba divers were inadequately prepared.

Directions: For each incident, circle the cause and the correct prevention of the incident most related to that incident.

On the way down a scuba diver experienced severe pain in the ears. This is probably caused by: 4400313

a. unequal air pressure outside and inside of the ear.
*b. unequal air pressure of inner ear and sinuses.
c. pressure of the water on the ears from outside.
d. water pushing against the ear drum.

Prevention may be accomplished by: 4400314

a. Use of ear plugs to keep water out of the ears.
b. An infection of the inner ear.
c. Remaining near the surface where water pressure is low.
*d. Swallowing frequently to open the Eustochion tube to equalize between sinuses and inner ear.

A diver spent 40 minutes at a depth of 120 feet. He came up too fast and later had severe pains in his joints. This condition is caused by: 4400315

a. Strenuous exercise under water.
b. Excess lactic acid in the blood.
*c. Released nitrogen gas forming bubbles in the blood.
d. Air that was contaminated with oil fumes.

This condition may be prevented by: 4400316

a. Taking a steam bath to eliminate absorbed gases.
b. Breathing pure oxygen to eliminate body waste.
c. Massaging the joints that are painful.
*d. Rising to the surface very slowly.

A diver, at a depth of 100 feet, rose to the surface too fast and suffered from severe chest pains. This condition was caused by: 4400317

a. The crushing
*b. Trying to hold a breath of air while rising.
c. Faulty operation of the regulator valve.
d. Air breathed under too high pressure.

This condition may be prevented by: 4400318

a. Adjusting the regulator valve to deliver more air.
b. Adjusting the regulator valve to deliver less air.
c. By not remaining at this depth for any length of time.
*d. Rising to the surface and constantly exhaling air to relieve the pressure.

A diver became irrational, felt intoxicated and lost control of his senses. This condition was caused by: 4400319

*a. Excessive nitrogen absorbed by the blood and tissues.
b. Excessive oxygen absorbed by the blood and tissues.
c. Excessive carbon dioxide absorbed by the blood and tissues.
d. Accumulation of body weight, i. e., toxemia

This condition may be prevented by: 4400320

a. Breathing ordinary air.
b. Adding carbon dioxide to stimulate the respiratory center.
*c. Remaining at a tolerable depth.
d. Not eating a heavy meal before diving.

A novice experienced the following symptoms: hallucinations nausea, convulsions and muscular twitches. This condition is caused by: 4400321

a. Breathing oxygen mixed with helium gas.
*b. Breathing pure oxygen.
c. Diving in extremely cold water.
d. Breathing air contaminated with carbon-monoxide.

This may be prevented by: 4400322

a. Filtering the gas used in a tank.
b. Breathing a special formula gas.
c. Taking a medicine to counteract these symptoms.
*d. Breathing ordinary air.

A skin diver, without an air tank, swimming in shallow water but under the surface becomes dizzy and loses consciousness. This condition is caused by: 4400323

a. Lack of sufficient oxygen.
b. Swimming after a heavy meal.
c. Congenital low blood pressure and anemia.
*d. Excessive accumulation of CO_2 in the blood.

It may be prevented by: 4400324

*a. Coming to the surface frequently to eliminate waste gases.
b. Building up the blood hemoglobin.
c. Taking a drug to increase blood pressure.
d. Rebreathing in a paper bag several times to accumulate carbon dioxide.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF AIR PRESSURE AND WATER PRESSURE IN RELATION TO SKIN DIVING BY SELECTING THE PROBABLE OUTCOME IN GIVEN SITUATIONS. 126

You and your friend have just completed a course in scuba diving. You are anxious to try your new equipment and skill in a rather deep lake. You each know something about water and air pressure from the scuba course and from physics in high school.

Could it be dangerous to suddenly strike out for the surface from a depth of 40 or 50 feet after often being down about 5 minutes? Circle the correct answer below. 4400303

a. It is not dangerous to do this because the air pressure regulator on the tank reduces the pressure of air as you rise.
b. Nitrogen gas mixed with the air in the tank is rapidly absorbed thus reducing the air pressure in the lungs.
*c. As you rise to the surface the pressure decreases. If you hold your breath, your lungs can expand beyond a normal limit and result in permanent damage.
d. The trick is to keep swallowing air as you rise so that the air does not get into your lungs to damage them.

If you have selected as your answer to the above item the principle that rising to the surface rapidly is a dangerous situation, what could you do to make this a safe operation? (Circle your answer below) 4400304

a. Adjust the air regulator valve to deliver less air to your lungs.
b. Inhale deeply to obtain maximum chest capacity.
*c. Exhale slowly and constantly while rising to reduce the pressure.
d. Adjust the air regulator valve to deliver more air but at a lower pressure.

You have been submerged at 50 feet for 60 minutes and you suddenly realize that your main supply of air is almost used up. Your tank does not have a reserve. You panic and head for the surface as fast as you can go. Assume that you reach the surface safely and board your boat, but later you experience painful joints all through your body. Which of the following is likely cause of the pain? 4400305

a. You were not used to the strenuous exercise and you ache all over.
*b. Released nitrogen gas from the blood comes out of solution and forms bubbles in the blood stream causing pain.
c. Coincidentally, with the diving experience you come down with symptoms of a severe virus infection.
d. The air in your tank was contaminated with carbon monoxide fumes from the pump. The pain was an aftermath of inhaling carbon monoxide.

As you dive your ears begin to ache. The pain increases with depth. How would you rectify this condition? 4400306

a. Insert ear plugs to keep the water from pressing on the ear drum.
*b. Swallow frequently to equalize the pressure of the air on your eustochian tube and internal ear with the air pressure in your lungs.
c. Manipulate your ears to release the air trapped in the external auditory meatus.
d. Your regulator is delivering an abnormal amount of air. Adjustment of the valve will stop the ear ache.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF VAPOR PRESSURE IN AN LIQUID - VAPOR EQUILIBRIUM BY IDENTIFYING CONDITIONS PRESENT WHEN SUCH AN EQUILIBRIUM EXISTS. 272

Identify the statement which is not true in a water liquid-vapor equilibrium at 25°C. 4400706

a. molecules are leaving the liquid phase
b. the manometer reads a constant pressure
c. molecules are entering the liquid phase
*d. the pressure changes as molecules change phase
e. no measureable changes are taking place

Identify the statement which is true in a ethylalcohol liquid vapor equilibrium 4400707

*a. no measureable changes are taking place
b. molecules lack energy to change phase
c. molecules are not entering vapor phase
d. the vapor pressure is increasing
e. the temperature of the system decreases

Source: Raytheon Chemistry, pp. 77-78.

THE STUDENT WILL APPLY HIS UNDERSTANDING OF THE VAPOR-PRESSURE TEMPERATURE RELATIONSHIP BY SELECTING STATEMENTS WHICH REFLECT CORRECT CHANGES IN VAPOR PRESSURE AFFECTED BY DIFFERING CONDITIONS. 273

A 500 ml vacuum flask is evacuated to 300 mm Hg pressure of air. A small amount of benzene is introduced into the system. At equilibrium liquid benzene remains. The vapor pressure of benzene at room temperature is 80 mm Hg.

Which of the following is not a proper vapor pressure shift due to the introduced change of condition. 4400708

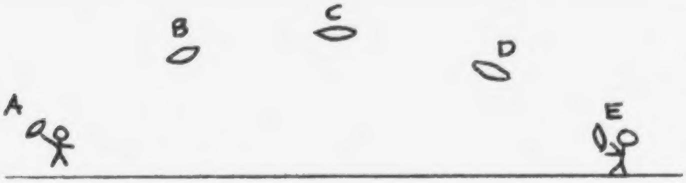
a. the flask pressure is changed to 500 mm Hg pressure of air, the vapor pressure is 80 mm Hg for the benzene.
b. an increase of temperature in the system will result in a higher vapor pressure for the benzene.
c. an increase of temperature in the system will result in greater air pressure.
*d. addition of a few drops of liquid benzene will significantly change the vapor pressure of benzene.
e. the addition of 50 ml of air by syringe will not affect the vapor pressure of benzene.

Source: Raytheon Chemistry, p. 79.

ENERGY

THE STUDENT WILL APPLY HIS UNDERSTANDING OF POTENTIAL ENERGY BY IDENTIFYING CONDITIONS OF MAXIMUM POTENTIAL IN EITHER DIAGRAM OR STATEMENT. 270

The quarterback throws a long pass to his end as illustrated. The potential of the football is maximum at point 4400702



a. A
b. B
*c. C
d. D
e. E

Which situation possesses the greatest potential 4400703

*a. brick held above head
b. brick falling at eye level
c. brick held at waist level
d. brick falling at knee level
e. brick striking foot

Source: Raytheon Chemistry, pp. 72-73

THE STUDENT CAN APPLY HIS KNOWLEDGE OF KINETIC ENERGY BY DETERMINING THE WAY IN WHICH THE KINETIC ENERGY OF AN OBJECT IS CHANGED WHEN GIVEN A CHANGE IN SPEED AND/OR MASS FOR THE OBJECT. 182

A certain mass is moving with a constant velocity *v*. If it speeds up to a final velocity *2v* its kinetic energy will be: 4400544

a. doubled
b. halved
c. quartered
*d. quadrupled
e. the same

A certain mass *m* moving at velocity *v* has an equal mass *m* dropped vertically down upon it so that it moves along now as a unit whose mass is 2m and its velocity is 1/2v. The kinetic energy is now: 4400545

a. doubled
*b. halved
c. quartered
d. quadrupled
e. the same

The kinetic energy of a 1 kg. mass moving 2 meters per second is 2 joules. We now cause it to move 4 meters per second, its kinetic energy now is: 4400546

a. 2 joules
b. 1 joule
c. 4 joules
d. 6 joules
*e. 8 joules

Source: *PSSC Physics,* Part III

THE STUDENT WILL SHOW HIS UNDERSTANDING OF THE DIFFERENCE BETWEEN MOMENTUM AND KINETIC ENERGY BY SELECTION OF PROPERTIES FOR OBJECTS IN MOTION RELATED TO EACH. 180

Momentum is most nearly described by which of the following? 4400536

a. F x d

*b. F x t

c. $\frac{F}{\Delta V}$

d. $\frac{F}{d}$

e. $\frac{F}{t}$

Kinetic energy is most nearly described by which of the following? 4400537

*a. F x d

b. F x t

c. $\frac{f}{\Delta V}$

d. $\frac{F}{d}$

e. $\frac{F}{t}$

Two objects are each accelerated from rest by identical springs compressed the same amount. If object A has a mass of M and object B as a mass of 10M, for the next five questions select from the choices below how the given property for object B compares with object A.

a. the same
b. exactly doubled
c. exactly 1/2
d. larger
e. smaller

*d momentum 4400538

*a kinetic energy 4400539

*d time for interaction of mass and spring 4400540

*e final velocity gained 4400541

*e acceleration 4400542

Source: PSSC physics, Part III.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF ENERGY STATES OF SUBSTANCES BY CORRECTLY INDICATING THE STATE WITH HIGHEST POTENTIAL OR KINETIC ENERGY. 149

Which is in the highest energy state A or B? If A and B are equal, mark C.

$$\overset{a}{\mathrm{AgCl(s)}} \overset{aq}{\rightleftharpoons} \overset{b}{\mathrm{Ag^{+} + Cl^{-}}}$$

4400415

a. a
*b. b
c. c

4400416

$$\overset{a}{\mathrm{Br_2\ (l)}} \rightleftharpoons \overset{b}{\mathrm{Br_2\ (g)}}$$

a. a
*b. b
c. c

$$\overset{a}{\mathrm{H_2O\ (s)}} \rightleftharpoons \overset{b}{\mathrm{H_2O\ (l)}}$$

4400417

a. a
*b. b
c. c

$$\overset{a}{\mathrm{H^{+} + OH^{-}}} \rightleftharpoons \overset{b}{\mathrm{H_2O}}$$

4400418

*a. a
b. b
c. c

$$\overset{a}{\mathrm{H_2O\ (g)}} \rightleftharpoons \overset{b}{\mathrm{H_2O\ (l)}}$$

4400419

*a. a
b. b
c. c

a b

H_2 (g) + 2O_2 (g) $\rightleftarrows$ H_2O (g) 4400420

*a. a
b. b
c. c

a b

2H $\rightleftarrows$ H_2 4400421

*a. a
b. b
c. c

a b

NaCl (s) $\overset{aq}{\rightleftarrows}$ Na^+ + Cl^- 4400422

a. a
*b. b
c. c

a b

NaCl (l) $\rightleftarrows$ NaCl (s) 4400423

*a. a
b. b
c. c

a b

Zn (s) Fe (s) 4400424

a. a
b. b
*c. c

a b

Fe^{3+} + SCN^- $\rightleftarrows$ $FeSCN^{2+}$ 4400425

a. a
*b. b
c. c

a b

$H_2(g) + I_2(g) \rightleftarrows 2HI(g)$ 4400426

*a. a
b. b
c. c

GIVEN A SERIES OF PROCESSES INVOLVING ENERGY CHANGES, THE STUDENT WILL BE ABLE TO RECALL THE DEFINITION OF ACTIVATION ENERGY BY SELECTING THE PROCESS WHICH BEST ILLUSTRATES THE CONCEPT OF ACTIVATION ENERGY. 28

Which of the following is most comparable to activation energy? The amount of energy 4400070

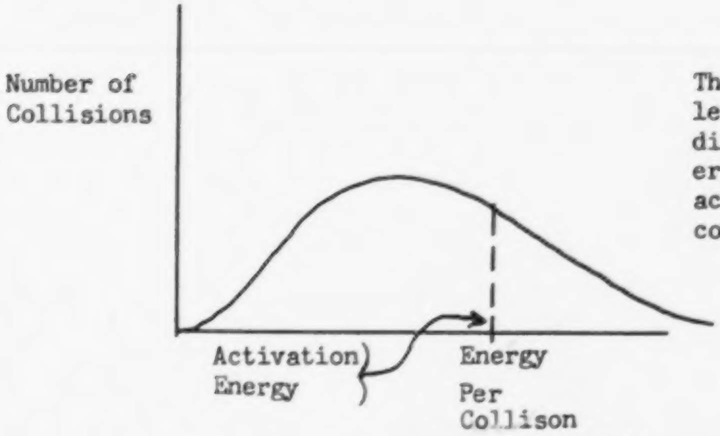
*a. needed to dent a car bumper.
b. needed to melt ice at 0°C.
c. released when coal burns.
d. needed to increase the speed of a car.

Source: Chemistry: Experiments and Principles, pages 211-213.

GIVEN A KINETIC ENERGY DISTRIBUTION CURVE WITH ACTIVATION ENERGY RECORDED ON IT, THE STUDENT WILL BE ABLE TO RECOGNIZE 29

1. WHICH PART OF THE CURVE REPRESENTS EFFECTIVE COLLISIONS.
2. HOW THIS PART CHANGES AS THE CURVE SHIFTS TO THE RIGHT.

BY CHOOSING THE STATEMENT WHICH BEST DESCRIBES INFORMATION PRESENTED IN THE CURVE.



The graph to the left represents the distribution of energies when two reactant molecules collide.

Which of the following represents the number of collisions which lead to reaction. 4400071

a. Highest point on the curve.
b. Height of the curve at "activation energy".
c. Area under the total curve.
*d. Area under the curve to the right of activation energy.

If average energy increases by 5%, the number of collisions which exceed activation energy 4400072

a. decreases
b. remains constant
c. increases by 5%
*d. increases by more than 5%

Source: Chemistry: Experiments and Principles, pages 211-213.

ATOMIC STRUCTURE

THE STUDENT WILL BE ABLE TO INTERPRET THE RUTHERFORD ALPHA PARTICLE SCATTERING EXPERIMENT BY SELECTING MACROSCOPIC OBJECTS ANALOGOUS TO THE NUCLEAR ATOM. 13

Sam wishes to show the result of the Rutherford alpha particle scattering experiment by shooting BB's at a solid object. Which of the following objects would be most suitable for his demonstration? 4400035

a. quarter inch plywood
b. thick cardboard
*c. chicken wire covered with newspaper
d. sheet metal with a roughened surface

Source: Chemistry: Experiments and Principles, pp. 131-135

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF ORBITAL ENERGY LEVEL DIAGRAMS BY DETERMINING THE GROUND STATE ELECTRON CONFIGURATION FOR ANY ELEMENT IN THE PERIODIC TABLE. 17

For which of the following reasons is $1s^2 2s^2 2p_x^2$ NOT a ground state configuration? 4400042

a. the lowest energy orbital available fills first.
*b. if two or more orbitals have the same energy, no pairing occurs until there is at least one electron in each orbital.
c. No more than two electrons can be found in one orbital.
d. The second cluster of orbitals holds eight electrons.

Source: Chemistry: Experiments and Principles, pp. 151-155.

For which of the following species is $1s^2 2s^2 2p^6$ NOT the ground state electron configuration? 4400043

a. Al^{+3} ion
b. F^- ion
c. neutral Ne atom
*d. neutral Na atom

Which of the following electronic configurations represents a titanium atom in its ground state? 4400044

*a. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$
b. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^2$
c. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$
d. $1s^2 2s^2 2p^6 3s^2 2d^{10}$

Source: Chemistry: Experiments and Principles, pp. 151-155.

THE STUDENT CAN DEMONSTRATE A KNOWLEDGE OF THE RELATION BETWEEN GROUND STATE ELECTRON CONFIGURATIONS AND IONIZATION ENERGY BY SELECTING THE APPROPRIATE REASON FOR A GIVEN IONIZATION RELATIONSHIP. 18

A: $1s^2 2s^2 2p^4$ B: $1s^2 2s^2 2p^5$

Which of the following statements best describes the relationship between the ionization energies of A and B? 4400045

a. The ionization energy of A is higher since there are fewer electrons in the 2p subshell.
b. The ionization energy of A is higher since A has a larger atomic radius.
c. The ionization energies are equal since the outermost electron is in a 2p orbital in both cases.
d. The ionization energy of B is higher since its outermost electron is unpaired.
*e. The ionization energy of B is higher since the nucleus of B has one more proton.

Source: Chemistry: Experiments and Principles, pages 158-161.

A: $1s^2 2s^2 2p^6 3s^1$ B: $1s^2 2s^2 2p^6 3s^2$

Which of the following statements best describes the relationship between the second ionization energies of A and B? 4400046

*a. The second ionization energy of B is lower since an inert gas electron population forms.
b. The second ionization energy of B is lower since B has more electrons than A.
c. The second ionization energies are equal since the outermost electron is in a 2s orbital in both cases.
c. The second ionization energy of B is higher since the nucleus of B has one more proton.
d. The second ionization energy of B is higher since B has a larger atomic radius than A.

Source: Chemistry: Experiments and Principles, pages 158-161.

THE STUDENT WILL BE ABLE TO PREDICT TRENDS IN IONIZATION ENERGY USING THE PERIODIC TABLE BY CHOOSING A STATEMENT WHICH BEST DESCRIBES A TREND IN A GIVEN MOVEMENT ACROSS THE PERIODIC TABLE. 19

Which of the following statements best describes the trend in first ionization energy as one moves down the alkaline earth metal family (Be, Mg, Ca, Sr, Ba, Ra)? 4400047

a. Ionization energy increases since nuclear charge increases.
b. Ionization energy increases since the valence electrons are in higher energy levels.
c. Ionization energy remains constant since each element has two valence electrons.
*d. Ionization energy decreases since atomic radius increases.
e. Ionization energy decreases since nuclear charge increases.

Which of the following statements best describes the trend in first ionization energy as one moves to the right across the second period? 4400048

*a. Ionization energy increases since nuclear charge increases.
b. Ionization energy increases since atomic radius increases.
c. Ionization energy remains constant since all valence electrons are in the same shell.
d. Ionization energy decreases since metallic character decreases.
e. Ionization energy decreases since number of valence electrons increases.

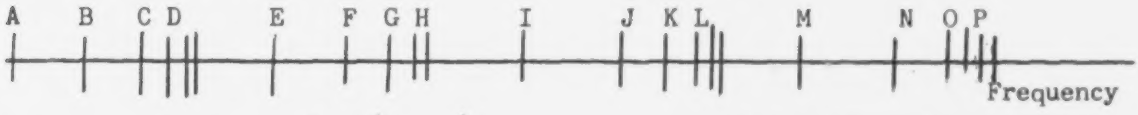
Source: Chemistry: Experiments and principles, pages 158-162.

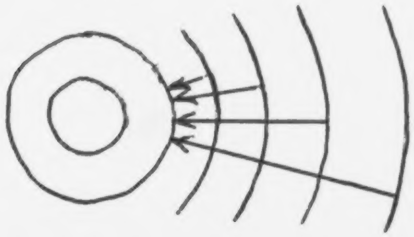
THE STUDENT WILL INTERPRET THE BOHR MODEL BY SELECTING STATEMENTS WHICH CORRECTLY RELATE THE BOHR MODEL FOR THE HYDROGEN ATOM TO THE HYDROGEN SPECTRUM. 20

According to the Bohr model, for which of the following reasons does hydrogen produce a line spectrum? 4400049

*a. A photon is emitted only when an electron drops from a higher to a lower energy level.
b. The electron emits photons as it rotates about the nucleus in circular orbits.
c. The electron radiates visible light only when it is close to the nucleus.
d. The electron cannot omit photons when its energy exceeds the ionization energy.

The emission spectrum for hydrogen has the general appearance shown below:





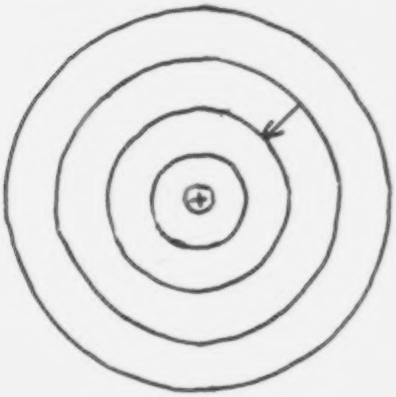
The diagram to the left represents a series of electronic transitions within the Bohr hydrogen atom.

To which series of spectral lines would the transitions give rise? 4400050

a. B, F, J, N
b. E, F, G, H
*c. I, J, K, L
d. C, G, K, O

Source: Chemistry: Experiments and Principles, pp. 142-145.

THE STUDENT CAN APPLY THE FORMULA FOR ELECTRONIC TRANSITIONS IN THE BOHR MODEL BY CALCULATING THE ENERGY OF PHOTONS EMITTED DURING ELECTRONIC TRANSITIONS. 21



The diagram to the left represents an electronic transition within the hydrogen atom. What is the energy of the photon emitted during this transition.

*a. $\frac{313.6}{9} - \frac{313.6}{16} \frac{\text{kcal}}{\text{mole}}$ 4400051

b. $\frac{313.6}{16-9} \frac{\text{kcal}}{\text{mole}}$

c. $\frac{313.6}{3} - \frac{313.6}{4} \frac{\text{kcal}}{\text{mole}}$

d. $\frac{313.6}{4-3} \frac{\text{kcal}}{\text{mole}}$

Source: Chemistry: Experiments and principles, pp. 142-145.

THE STUDENT WILL DEMONSTRATE A KNOWLEDGE OF TERMS RELATED TO ATOMS WHEN GIVEN THE NUMBER OF PROTONS AND NEUTRONS IN THE NUCLEUS OF AN ATOM, BY DETERMINING THE ATOMIC NUMBER, CHEMICAL SYMBOL, AND MASS NUMBER OF THE ATOM. 23

The nucleus of an atom contains 27 protons and 33 neutrons. What is the correct symbol for this atom? 4400055

a. $27\ \mathrm{CO}^{33}$

*b. $27\ \mathrm{CO}^{60}$

c. $33\ \mathrm{As}^{60}$

d. $6\ \mathrm{C}^{33}$

e. $33\mathrm{As}^{27}$

Chemistry: Experiments and Principles, pp. 135-7.

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF ELECTRON CONFIGURATION BY SELECTING THE CORRECT CONFIGURATION FOR A GIVEN ELEMENT OR ION. 54

The correct electron configuration of the Al^{3+} ion is 4400151

a. $1s^2 2s^2 2p^6 3s^2 3p^1$

b. $1s^2 2s^2 2p^6 3s^2 3p^0$

*c. $1s^2 2s^2 2p^6$

d. $1s^2 2s^2 2p^6 3s^1$

O'Conner et al Chemistry: Experiments and Principles, p. 157

THE STUDENT WILL DEMONSTRATE A KNOWLEDGE OF THE TERMS FOR ATOMIC STRUCTURE HYPOTHESIS BY SELECTING THE CORRECT TERMS FOR GIVEN DESCRIPTIONS. 146

High frequency invisible rays released in radioactive decay are 4400395

a. cosmic rays
b. electron streams
c. cathode rays
*d. gamma rays
e. none of these

The atom has total charge which is 4400396

*a. neutral
b. positive
c. negative
d. static
e. none of these

The electrons in the final s and p orbitals are known as 4400397

a. negative charge
b. lowest energy state
c. ionization electrons
*d. valence electrons
e. Beta rays

Atomic particles located in the nucleus are 4400398

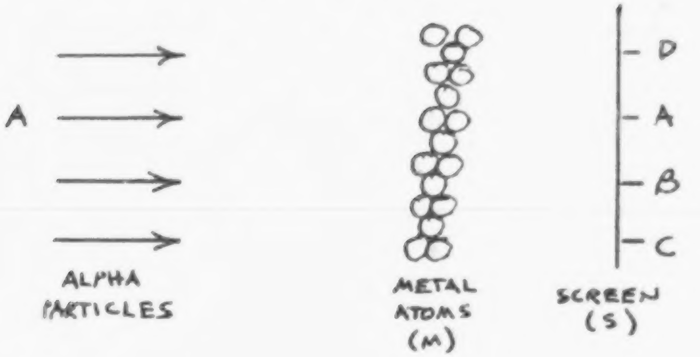
a. alpha particles
b. protons
c. electrons
d. neutrons
e. gamma rays

Best answer is:

a. a & b
b. b & c
c. c & e
*d. b & d
e. none of the above

$H_e \rightarrow 2_e^{-} +$ __________ 4400399

a. neutrons
b. cathode rays
c. atoms
*d. alpha particles
e. He^{2-}


A
ALPHA PARTICLES
METAL ATOMS (M)
SCREEN (S)
D
A
B
C

When alpha particle A passes through atoms of metal foil (M), where would A hit screen S? 4400400

a. A and B
b. B and C
c. C and D
*d. all of them
e. answer not given

Of the small units in atoms, the ones with the greatest mass are 4400401

a. electrons
b. gamma rays
c. beta rays
*d. alpha particles
e. neutrons

What do you know about two elements A and B is $Z_A = 16$, $Z_B = 18$, $N_A = 8$, $N_B = 10$? 4400402

a. equal in mass
*b. isotopes
c. inert gases
d. alkali metals
e. none of these

Source: Raytheon, Chemistry, Chapter 8.

THE STUDENT DEMONSTRATES HIS COMPREHENSION OF ENERGY STATES BY CORRECTLY IDENTIFYING CHARACTERISTIC STATEMENTS OF ELECTRON DISTRIBUTION FROM A LIST. 147

Which of these statements are NOT true? 4400403

a. Electron energy levels are called stationary states of an element.
b. The ionization energy of an element is the amount of energy necessary to raise an electron to a higher energy level.
c. An electron stays in its stationary state unless the element is ionized.
d. Light is emitted when the first ionization energy is added to the element.
e. Balmer lines are visible when a hydrogen electron changes from a higher level to level 2.

a. a and b
b. b and c
c. a, b, and e
*d. b, c, d
e. c and e

Which of these statements are true? 4400404

a. Each element has a characteristic pattern of light emission line spectra.
b. The line spectrum for hydrogen is one of the most complex.
c. For a particular quantum number of hydrogen the n^2 orbitals have the same energy.
d. A spectral line is emitted as an electron drops from a higher energy state.
e. The electron configuration indicates the spectral lines.

*a. a, c, d
b. b, c
c. a, b, c
d. a, c, e
e. all of them

Source: Raytheon Chemistry, Chapter 9

THE STUDENT WILL EXHIBIT HIS ABILITY TO ANALYZE THE RESULTS OF THE RUTHERFORD SCATTERING EXPERIMENT BY STATING THE MOST UNEXPECTED AND SURPRISING RESULT FROM THE ACTUAL RESULTS. 181

The most unexpected result from the Rutherford scattering experiment was: 4400543

a. That most alpha particles went through undeflected.
b. That most alpha particles that were deflected, changed their paths by only a few degrees.
*c. That a very few alpha particles were deflected through an angle of 90° or more.
d. That alpha particles caused a scintillation on the detector screen even after deflection.

Project Physics, Part V.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO RECALL THE EARLY ORIGINS OF THE ATOMIC THEORY BY RECOGNIZING SOME OF THE FIRST ASSUMPTIONS USED. 191

All but one of the following are assumptions used by the early Greeks in the first atomic theory of matter. Select the one NOT applicable. 4400562

a. material things consist of very minute indivisible particles.
b. matter is eternal; it cannot pass into nothingness.
c. All atoms are of the same substance, differing only in size, shape, and position.
*d. atoms are locked in motionless position to form solids.
e. atoms are able to move for reasons not clear.

John Dalton assumed that if a compound consists of two elements A and B, one atom of A always combines with: 4400563

*a. one atom of B
b. one or more atoms of B
c. two or more atoms of B
d. B in any ratio of small whole numbers

THE STUDENT WILL EXHIBIT HIS COMPREHENSION OF ELECTRICAL CHARGE AND THE ELECTRON-PROTON MODEL BY SELECTING STATEMENTS WHICH DESCRIBE THE MODEL. 275

All of the following statements support the electron-proton model except 4400711

a. the basic unit charge of electricity is either positive or negative.
b. the particle with one basic unit of positive charge is the proton.
c. atoms and molecules are electrically neutral, possessing zero electrical charge.
*d. atoms which are electrically neutral are made up of neutrons.
e. molecules possessing different number of electrons and protons are called ions.

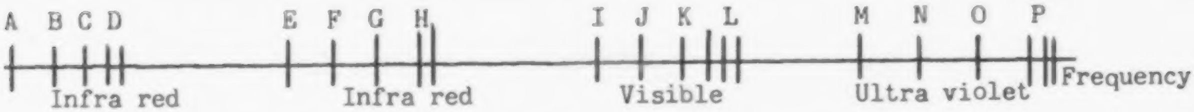
Which of the following statements best describes an ion? 4400712

a. contains protons
b. contains neutrons
c. zero electrical charge
*d. unequal electron-proton ratio
e. charged particle

Source: Raytheon Chemistry, p. 90-92.

THE STUDENT WILL DEMONSTRATE THE ABILITY TO IDENTIFY CORRECT RELATIONSHIPS BETWEEN THE RYDBERG EQUATION AND THE HYDROGEN SPECTRUM BY SOLVING PROBLEMS RELATED TO THE EQUATION AND THE DIAGRAM OF THE SPECTRUM. 14

The emission spectrum for hydrogen has the general appearance shown below:



The frequency of all lines in this spectrum can be determined by the following equation:

$$\nu = 3.29 \times 10^{15} \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

Which of the following is true for the lines lettered M, N, O, P? 4400036

*a. n_1 has the same numerical value
b. n_1 is greater than n_2
c. n_1 increases with frequency
d. n_2 is constant

For which spectral line does $n_1 = 3$ and $n_2 = 5$? 4400037

a. B
*b. F
c. J
d. O

For which group of lines is n_2 equal to $n_1 + 1$? 4400038

*a. A, E, I, M
b. E, F, G, H
c. D, H, L, P
d. A, F, K, P

Chemistry: Experiments and Principles, pp. 126-137.

HEAT

THE STUDENT WILL BE ABLE TO DIFFERENTIATE GIVEN PROCESSES BY CHOOSING THE CORRECT DESCRIPTION OF INCREASE OR DECREASE IN HEAT CONTENT OR ENTROPY FOR EACH PROCESS. 30

Directions: The following statements refer to processes which involve changes in heat content and entropy.

Circle
a. if the process involves an increase both in heat content and entropy
b. if the process involves an increase in heat content but a decrease in entropy
c. if the process involves a decrease in heat content but an increase in entropy
d. if the process involves a decrease both in heat content and in entropy

Liquid water at 100°C turns to steam at 100°C. 4400073

*a.
b.
c.
d.

Solid NI_3 explodes, forming nitrogen and iodine vapor. 4400074

a.
b.
*c.
d.

An electric current is passed through a copper chloride solution forming copper at the cathode and chlorine at the anode. 4400075

a.
*b.
c.
d.

Solid $Na_2S_2O_3 \cdot 5H_2O$ crystallizes from a solution containing sodium ions and thiosulfate ions. 4400076

a.
b.
c.
*d.

Chemistry: Experiments and Principles, pages 246-250.

GIVEN THE ALGEBRAIC SIGN OF THE FREE ENERGY CHANGE FOR A PROCESS OR INFORMATION FROM WHICH THIS SIGN CAN BE DEDUCED, THE STUDENT WILL DESIGNATE WHETHER OR NOT THE PROCESS IS SPONTANEOUS BY SELECTING THE CORRECT DESCRIPTION OF EACH PROCESS. 31

Directions: Information about several processes is given below. Circle

a. if the forward process is spontaneous.
b. if the system is at equilibrium.
c. if the reverse process is spontaneous.
d. if none of the above conclusions can be reached without additional information.

$\Delta G = 0$ 4400077

a.
*b.
c.
d.

$\Delta H < 0$ and $\Delta S > 0$ 4400078

*a.
b.
c.
d.

$\Delta H > 0$ and $\Delta S > 0$ 4400079

a.
b.
c.
*d.

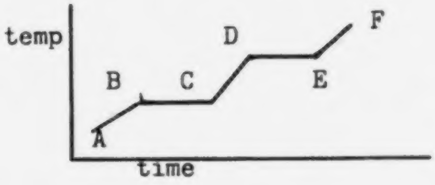
$\Delta H > 0$ and $\Delta S < 0$ 4400080

a.
b.
*c.
d.

Chemistry: Experiments and Principles, pages 249-250.

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF PLOTTED STATES OF PHYSICAL MATTER BY IDENTIFYING A PHYSICAL STATE AT A PARTICULAR POINT IN TIME AND TEMPERATURE FROM A LIST OF ALTERNATIVES. 45

Given the following plot of experimental data, between what points on the plot is the substance in the solid state only?

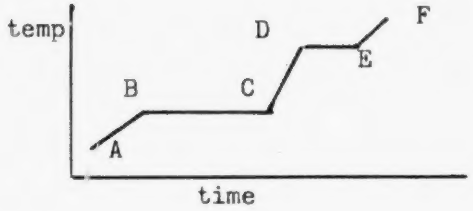


4400137

*a. A - B
b. B - C
c. C - D
d. D - E
e. E - F

O"Conner et al Chemistry: Experiments and Principles, p. 74

Given the following plot experimental data, between what points on the plot is the substance in just the liquid state?



a. A - B
b. B - C
*c. C - D
d. D - E
e. E - F

4400138

THE STUDENT WILL APPLY THE KINETIC THEORY OF HEAT AND PRESSURE BY CORRECTLY IDENTIFYING FROM A LIST THE CHANGE IN KINETIC ENERGY CAUSED BY THE CHANGE IN PHYSICAL STATE OF A SUBSTANCE. 46

When you heat a solid, would you predict the average kinetic energy of the molecules to 4400139

a. decrease
*b. increase
c. remain the same

When you melt a solid, would you predict the average kinetic energy to (temp. constant) 4400140

a. decrease
b. increase
*c. remain the same

O'Conner et al Chemistry: Experiments and Principles, pp. 66-67.

THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF THE RELATIVE MAGNITUDE OF THE FORCES ACTING BETWEEN MOLECULES BY DETERMINING THE STATE OF A SUBSTANCE AS EITHER A SOLID, LIQUID, OR A GAS. 49

The forces between molecules of a substance are very weak. Predict the state of the substance. 4400144

a. liquid
b. solid
*c. gas

O'Connor et al Chemistry: Experiments and Principles, p. 71

THE STUDENT WILL BE ABLE TO APPLY THE THEORY OF ENTROPY AND ENERGY BY PREDICTING THE PROBABLE CHANGES ON A GIVEN SYSTEM. 86

Directions: Assume you are observing the dance floor at a school dance. Select the alternative that best describes the situation.

At the start, the band is playing a slow number. 4400203

*a. Energy is low; entropy is high.
b. Energy is high; entropy is high.
c. Energy is low; entropy is low.
d. Energy is high; entropy is low.

The band now is playing a very fast tempo number. 4400204

a. Energy is low; entropy is high.
*b. Energy is high; entropy is high.
c. Energy is low; entropy is low.
d. Energy is high; entropy is low.

The band is now playing the "bunny hop." 4400205

a. Energy is low; entropy is high.
b. Energy is high; entropy is high.
c. Energy is low; entropy is low.
*d. Energy is high; entropy is low.

THE STUDENT WILL APPLY THE RELATIONSHIP OF ENERGY AND ENTROPY BY PREDICTING THE CONDITIONS NEEDED TO ACHIEVE A STATED GOAL. 89

Assume that the roles of energy and entropy are reversed. You are in the syrup business and must dissolve sugar in water as one of the steps in making your product. For purposes of this question, we will assume that the process of dissolving sugar is endothermic. Which of the following conditions would you use to make the most sugar dissolve? 4400212

a. cold and extreme dilution
b. heat and extreme dilution
c. cold and very slight dilution
*d. heat and very slight dilution

Chemical procedures often call for the precipitation of a dissolved solid from a solvent. Which of the following procedures would most likely be used to achieve this goal? 4400213

a. heat it.
*b. cool it.
c. shake it.
d. centrifuge it.
d. add more solvent.

THE STUDENT CAN APPLY THE CONCEPT OF HEAT OF FUSION BY SELECTING CORRECT SOLUTIONS TO PROBLEMS INVOLVING HEAT CHANGE. 129

If 100 ml. of water are cooled 50° C. then the number of grams of $H_2O_{(s)}$ melted by the released calories is 4400325

a. 1.44
b. 3.48
c. 1,8 x 10
*d. 6.25 x 10
e. 5 x 10^3

If 100 ml. of water are cooled 45° C and 5.46 x 10 g. of $H_2O_{(s)}$ are melted, what is the calculated experimental heat of fusion in cal. per Mole of H_2O? 4400326

a. 1.36
b. 1.40
c. 1.46 x 10
d. 1.44 x 10^3
*e. 1.48 x 10^3

Which of the following is NOT true? The melting of ice 4400327

a. is fusion of $H_2O_{(s)}$
b. is a phase change
*c. causes a substance of lower potential energy to be formed.
d. produces a substance of higher Kinetic energy
e. produces a substance in a less condensed state

Source: Lab Manual, Text p. 74, Raytheon Chemstudy.

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF TERMS USED IN PHASE CHANGE BY SELECTING ANSWERS TO QUESTIONS IN RELATION TO DIFFERENT CHANGES IN STATES OF MATTER. 136

Boiling occurs when vapor pressure of a liquid and atmospheric pressure ________. 4400343

a. increase
*b. are the same
c. are sublimations
d. decrease
e. are fusions
f. answer not given

Phase changes from solids to gases ________. 4400344

a. increase
b. are the same
*c. are sublimations
d. decrease
e. are fusions
f. answer not given

Vapor pressure of liquid increases when temperatures ________. 44004400345

*a. increase
b. are the same
c. are sublimations
d. decrease
e. are fusions
f. answer not given

During changes of liquids to solids degrees of condensation ________. 4400346

*a. increase
b. are the same
c. are sublimations
d. decrease
e. are fusions
f. answer not given

Boiling can be achieved at a lower temperature by atmospheric pressure ____________. 4400347

a. increase
b. are the same
c. are sublimations
*d. decrease
e. are fusions
f. answer not given

During phase change, temperatures ________. 4400348

a. increase
*b. are the same
c. are sublimations
d. decrease
e. are fusions
f. answer not given

Source: Raytheon Chemstudy, Chap. 5, p. 78

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO ANALYZE THE RELATIONSHIP BETWEEN HEAT AND TEMPERATURE BY INDICATING AN EXPLANATION TO SITUATIONS WHICH APPEAR TO CONTRADICT THAT RELATIONSHIP. 177

Directions: Indicate the correct answer and explanation for the following statements.

An iceberg contains more heat than a cup of steaming hot tea. 4400531

a. False. The temperature of the iceberg is 0°C and the Temperature of the tea is 100°C.
b. False. The iceberg is pure water but the tea is not.
c. False. The iceberg forms in salt water which means its temperature is lower than 0°C.
d. True. Even though the temperature of the iceberg is lower it contains more heat because it is a solid.
*e. True. The amount of total heat present in a massive iceberg with a low temperature would be more than the total heat present in a cup of tea with a high temperature.

Three liters of water at a temperature of 70°C contains more heat then two liters of water at 100°C. 4400532

*a. True. Even though the average amount of heat present in the three liters is less than that of two liters, the total amount of heat present would be more.
b. True. The temperature of two liters of water at 100°C would drop more than three liters of water at 70° if two liters of ice water is added to each.
c. False. Since temperature is a measurement of heat, more heat is present in the two liters of water.
d. False. Since two liters of water at 100°C would evaporate in less time than three liters of water at 70°C, more heat must be present in the two liters of water.
e. False. A thermometer in the three liters would show an increase in temperature if the two liters were poured into it while a thermometer in the two liters would show a decrease in temperature if the three liters were poured into it.

Source: ESCP Investigating Earth Science, Chapter 6, Houghton Mifflin Co.

THE STUDENT WILL EXHIBIT HIS ABILITY TO COMPREHEND THE SECOND LAW OF THERMODYNAMICS "INCREASING OF ENTROPY" BY IDENTIFYING A SITUATION WHICH IS NOT CONSISTENT WITH IT. 217

From the list below, choose the case which is not consistent with the concept of the state of increasing entropy. The case in which 4400605

a. all mechanical energy has been transformed into heat energy.
b. all heat energy has been transformed into other forms of energy.
c. the temperature of the universe decreases toward absolute zero.
d. heat does not naturally flow from cold bodies to hot bodies.
*e. the supply of coal and oil has been depleted.

Source: Project Physics, ch. 11.6.

THE STUDENT WILL EXHIBIT HIS ABILITY TO COMPREHEND THE PROCESSES THAT INVOLVE THE REVERSIBILITY PARADOX BY RECOGNIZING PROPERTIES THAT MAKE EVENTS EITHER REVERSIBLE OR IRREVERSIBLE. 219

The kinetic energy of falling bodies changes into heat energy upon impact. The reason this is an irreversible process is: 4400607

a. Motions governed by Newton's law are irreversible.
b. The reversible process would not conserve energy.
c. The reversible process would not conserve momentum.
*d. There is little chance the molecules will order themselves so that the reverse occurs.
e. There are no processes that are reversible.

Of the following choose which represents a reversible process. 4400608

a. a pendulum swinging in air.
b. water falling in a cataract.
*c. two molecules colliding elastically
d. an ice cube melting in a drink
e. there are no processes that are reversible.

Source: Project Physics, Chapter 11.8.

THE STUDENT WILL EXHIBIT HIS ABILITY TO ANALYZE THE SECOND LAW OF THERMODYNAMICS BY BEING ABLE TO PICK OUT ITS IMPLICATIONS. 220

The second law of thermodynamics informs us that heat will not naturally flow from a cooler to a hotter body. The implications of this are best illustrated by which of the following? 4400609

a. This means that theoretically an air conditioner shouldn't work.
b. This is a fundamental law of physics.
*c. This is a statistical law showing a low probability
d. This is because molecular motion is random.
e. All of the above are illustrated by this law.

Source: Project Physics, Ch. 11

THE STUDENT WILL DEMONSTRATE ABILITY TO RECOGNIZE PHASE CHANGES BY SELECTING EXAMPLES OF SUCH CHANGES. 266

Which of the following is not an example of a phase change? 4400696

a. the melting of ice
b. the evaporation of gasoline
*c. the crushing of rock
d. the freezing of mercury
e. the condensation of alcohol

From the following statements identify the number of phase changes present. 4400697

Salt water was pumped into evaporating beds to remove water. The water was condensed and bottled as distilled water, as well as frozen into crystal clear ice cubes. The salt was heated and when molten poured into molds to solidfy. These pellets were used to melt ice on the city streets.

a. 5
b. 8
c. 2
*d. 7
e. 10

Source: Raytheon Chemistry, p. 71.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF THE MEANING OF TEMPERATURE BY IDENTIFYING STATEMENTS WHICH GIVE MEANING TO THE TERM TEMPERATURE. 267

Identify this statement regarding the meaning of temperature which is false. 4400698

a. any substance that has the property to change temperature can be used as a thermometer.
b. translational molecular motion is a measure of temperature.
c. two gases at the same temperature possess the same average kinetic energy.
*d. two gases at the same temperature possess the same average velocity.
e. two gases at the same temperature are in thermal equilibrium.

Source: Raytheon Chemistry, pp. 59-60.

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE MOLAR HEATS OF FUSION AND VAPORIZATION DURING PHASE CHANGES BY CALCULATING THE ENERGY CHANGE IN A PHASE CHANGE. 271

The amount of heat energy measured in kilocalories necessary to change 36 grams of ice into water is 4400704

a. 1.44 kcal
b. 7.20 kcal
c. 14.4 kcal
*d. 2.88 kcal
e. 28.8 kcal

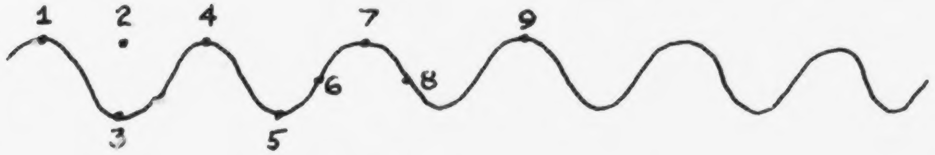
The amount of heat energy measured in kilocalories necessary to change 3 moles of water to steam is 4400705

a. 23.7 kcal
b. 1.94 kcal
*c. 29.1 kcal
d. 19.4 kcal
e. 2.91 kcal

Source: Raytheon Chemistry, pp. 75-76.

WAVES

THE STUDENT CAN RECALL DEFINITIONS OF TERMS USED IN WAVE THEORY BY ASSOCIATING DEFINITIONS OF WAVE-LENGTH, FREQUENCY, AND SPEED WITH SYMBOLS ON A DIAGRAM OF A ONE DIMENSIONAL WAVE. 22



The diagram shown here represents a side view of water waves. The distance between points 1 and 2 is 2.0 meters. The frequency of the wave is 0.5 cycle per second.

To find wavelength, one would measure the distance between which of the following pairs of points? 4400052

a. 2 and 3
*b. 3 and 5
c. 5 and 7
d. 6 and 8

Where would point 1 appear to be after 4 seconds? 4400053

a. point 4
b. point 5
*c. point 7
d. point 9

The speed of the wave in meters per second is 4400054

*a. 4.0 x 0.5
b. 4.0 ÷ 0.5
c. 2.0 x 0.5
d. 0.5 ÷ 2.0

Chemistry: Experiments and Principles, pp. 122-123.

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF X-RAYS BY RECOGNIZING THEIR PROPERTIES AND SOME PROPERTIES THEY DO "NOT" EXHIBIT FROM A LIST. 178

Of the following properties, which one is not a property of X-Rays? 4400533

a. They are part of the electro-magnetic spectrum.
b. They are deflected by magnetic and electric fields.
*c. They have extremely short wave lengths.
d. They have large energies.

Source: Project Physics, Part V.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO RECALL THE BASIC NATURE OF WAVES BY IDENTIFYING THEIR CHARACTERISTICS CORRECTLY. 221

The phenomena of wave interference involves 4400610

a. constructive interference
b. destructive interference
c. formation of modal areas
d. formation of larger waves
*e. under various conditions all of the above

In the direction of wave motion, which of the following is transferred? 4400611

a. the medium used
b. the mass
*c. the energy
d. the force
e. the speed

Which of those below are responsible for wave speed? 4400612

a. the medium's mass
b. the medium's elasticity
c. the medium's density
d. both a and b above
*e. both b and c above

The meaning of "wave propagation" is best described by 4400613

a. movement along a medium
b. traveling through a medium
c. reforming their shape on a slinky
*d. all of the above
e. none of the above

Below are some kinds of waves. Select the one that is not of a distinctive nature. 4400614

a. longitudinal wave
*b. horizontal wave
c. torsional wave
d. transverse wave
e. compressional wave

The energy a wave may contain is not shown by which of the following choices? 4400615

a. wave length
b. frequency
c. amplitude
d. all of the above
*e. none of the above

THE STUDENT WILL DISPLAY HIS ABILITY TO COMPREHEND THE FACTS OF DIFFRACTION AS A WAVE PHENOMENA BY RECOGNIZING THE CONDITIONS UNDER WHICH DIFFRACTION IS PRODUCED. 222

The phenomena of light diffraction was not discovered for centuries chiefly because: 4400616

a. the speed of light is very fast
*b. light is such a short wave length
c. light seldom bends around corners
d. light was seldom sent through holes
e. light waves have a very small amplitude

The phenomena of diffraction is most noticeable under which of the following conditions for passing through an opening? 4400617

a. The wave length is small compared to the opening.
b. The opening is very small.
*c. The opening and the wave are in the same order of magnitude for size.
d. The light has a very high frequency.
e. The light is of low frequency and the opening large.

THE STUDENT WILL DISPLAY HIS ABILITY TO APPLY THE PHENOMENA OF DIFFRACTION BY SELECTING A CORRECT SITUATION FOR THE PHENOMENA IN SOUND WAVES. 223

A double outside door is open in the fieldhouse where the orchestra is practicing for commencement. You are walking along the sidewalk adjacent to the open door and begin to hear the music. Which of the following do you hear first? 4400618

a. the piccolo
b. the trombone
*c. the bass horn
d. they all are first heard simultaneously from a distance
e. none are heard until you are opposite the door then all are heard at once.

Even though a band may be a large distance away, the sound of all the various low and high pitched instruments arrive at your ear "in step". The reason for this is that sound waves 4400619

a. do not interfere with each other
b. are longitudinal waves
c. are polarized
*d. travel at the same speed for all frequencies
e. are slower than light waves

THE STUDENT WILL DISPLAY HIS ABILITY TO RECALL THE FACTS OF THE INDEX OF REFRACTION PHENOMENA BY DISTINGUISHING CORRECT IDEAS FROM SEVERAL GIVEN. 224

Which of the following does not express an index of refraction? 4400620

a. sin i/ sin r
b. angle i/ angle r
*c. λ_1/λ_2
d. v_1/v_2
e. n_2/n_1

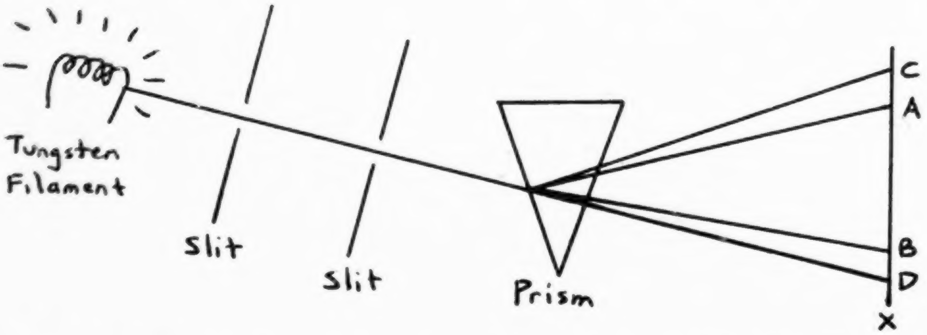
The relative index of refraction for a given pair of media: 4400621

a. changes with the color of light.
*b. is always less than one.
c. can predict the critical angle.
d. may result in no change of path for the light.
e. predicts the change of frequency of the light waves.

Source: Project Physics, ch. 13.

LIGHT

THE STUDENT WILL RECOGNIZE THAT THE HUMAN EYE IS SENSITIVE TO ONLY A SMALL PART OF THE LIGHT SPECTRUM BY CHOOSING THE BEST EXPLANATION FOR A GIVEN EXPERIMENT'S RESULT. 16



The white light from a tungsten filament is split into its component colors by a prism. When a piece of white paper is placed at position X, colors are observed from A to B. When the white paper is replaced by a photographic film, the film is darkened from C to D. Which of the following statements best explains this observation. 4400041

*a. The film is sensitive to a wider range of colors than the human eye.
b. The colors in regions A-C and B-D are too dim to be seen.
c. The source emits more colors when the film is in place than when the paper is in place.
d. Light scattered within the prism is recorded by the film.

Chemistry: Experiments and Principles, pp. 123 and 124.

THE STUDENT WILL ANALYZE A SCIENTIFIC EXPERIMENT CONCERNING THE EFFECT OF LIGHT DURATION ON PLANT FLOWERING, BY IDENTIFYING RELATIVE ASPECTS OF THE EXPERIMENT FROM A SERIES OF QUESTIONS. 127

John's science fair's project is entitled "The Effect of Duration of Light on Flowering of Plants." In light of conducting a reliable scientific experiment answer the questions listed below:

Which item below is relevant to the experiment? 4400307

a. gravity
b. Geographic location
*c. Temperature
d. Altitude

Which of the following would be considered an independent variable? 4400308

a. type container
*b. light
c. water
d. p H

A control experiment is used to 4400309

a. provide consistency
b. provide reproducibility
c. provide accuracy
*d. provide comparison

Which item is irrelevant to the experiment? 4400310

a. air contamination
b. humidity and temperature
*c. time of the year
d. nutrients required for growth

Which is this experiment would have to be constant for all samples? 4400311

a. gravitational pull
b. same person doing experiment
c. duration of light
*d. soil composition

Which of the following would be considered the dependent variable? 4400312

a. number of times plant was watered
b. assurance of soil sterility
c. filtration of air
*d. growth of the plants

THE STUDENT WILL SHOW HIS ABILITY TO ANALYZE THE WAY PHOTOELECTRONS ARE EMITTED FROM A PHOTO-ELECTRIC SURFACE BY PREDICTING WHAT CHANGES TAKE PLACE WHEN LIGHT INTENSITY IS ALTERED. 179

A clean surface of potassium metal is exposed to violet light and electrons are emitted. If the intensity of the violet light is increased, which of the following also increase? 4400534

1. the charge of each electron emitted
2. the energy of each electron emitted
3. the number of electrons emitted per second

a. 1 only
b. 2 only
*c. 3 only
d. 1 and 2
d. 1, 2 and 3

The light meter of a camera will show a lower reading in the shade because photo-electrons emitted in the photo-cell are now: 4400535

a. of lower energy
b. of lower speed
c. of smaller size
*d. of fewer numbers
e. of less intensity

Source: Project Physics, Part V.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO APPLY THE PRINCIPLES OF REFRACTION, REFLECTION, AND DISPERSION BY SELECTION OF CORRECT FACTS TO EXPLAIN GIVEN PHENOMENA. 211

The rainbow phenomenon can be explained by the facts of: 4400594

a. reflection
b. refraction
c. dispersion
d. dispersion and refraction
*e. reflection, refraction and dispersion

The display of the complete spectrum of color from white light passing through a prism can be explained by the facts of 4400595

a. reflection
b. refraction
c. dispersion
*d. dispersion and refraction
e. reflection, refraction and dispersion

Source: PSSC Physics, ch. 13.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO RECALL THE PROPERTIES OF VIRTUAL AND REAL IMAGES BY IDENTIFYING EXAMPLES OF EACH. 212

From the list of properties most apply to virtual as well as to real images. Select the one property which is valid only for virtual images. 4400596

a. location
b. size
c. position
*d. upright
e. inverted

Source: PSSC Physics, ch. 12.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO APPLY SHADOW FORMATION BY CHOOSING PROPER DISTANCE RELATIONSHIPS TO OBTAIN DESIRED RESULTS. 216

You are holding an object between a moveable light source and a portable screen. From the list below pick the choice where the shadow cast on the screen will be smaller with less fuzziness of the edges. 4400603

a. You move the light closer to the object.
b. You move the screen further from the object.
c. You move the object toward the light.
*d. You move the object away from the light.

To make the shadow of an object more fuzzy at the edges, you would not 4400604

a. use a larger light source.
*b. move the object further from the light.
c. use a longer light source (a flourescent tube).
d. move the screen closer to the object.

Source: PSSC Physics, ch. 12.1

THE STUDENT WILL DISPLAY HIS ABILITY TO RECALL THE THEORY OF COLOR BY NEWTON BY IDENTIFYING THE CONSEQUENCES OF THAT THEORY. 225

The reason, according to Newton, a yellow colored object appears yellow to the eye is best described by: 4400622

a. the object adds an impurity to the "pure" white sunlight as it is reflected back to the eye.
b. the object will absorb all yellow light falling on it.
c. the object seems yellow due to interaction of white light and its opposite, darkness.
d. all the sunlight is reflected by the object.
*e. the object reflects from incident light, mainly the yellow part.

Newton discovered that "pure" white light was made up of apparent colors by experimentation with: 4400623

a. reflection
b. displacement
*c. refraction
d. diffraction
e. scattering

Newton allowed a green ray of light to enter a prism. The result was: 4400624

a. it went through with no change whatever.
b. it went through and emerged as white light.
c. it emerged with distinct blue and yellow parts.
*d. it emerged still as green light.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO APPLY THE FACTS OF THE PHENOMENA OF COLOR BY RECOGNIZING THE REASON FOR THE SKY BEING BLUE. 229

The reason for the blue sky is best given by: 4400630

a. mostly blue light penetrates air and dust molecules of the atmosphere.
b. blue light has more energy due to its high frequency.
c. red light is scattered most by air and dust molecules in the atmosphere.
*d. blue light is scattered most by air and dust molecules in the atmosphere.
e. blue light is reflected most by air and dust molecules in the atmosphere.

Source: Project Physics, ch. 13,7.

THE STUDENT WILL DISPLAY HIS ABILITY TO COMPREHEND THE FACTS OF LIGHT POLARIZATION BY IDENTIFYING ITS SALIENT IDEAS FROM OTHERS. 228

The successful investigation into which of the following showed that light waves were transverse? 4400628

a. reflection
b. refraction
*c. polarization
d. diffraction
e. scattering

The wave form of polarized light is 4400629

*a. the simplest kind of wave.
b. a complicated three-dimensional wave.
c. shows a tendency to exhibit north and south poles.
d. are longitudinal wave forms.
e. are not understood by scientists today.

Source: Project Physics, ch. 13.7.

ELECTRICITY AND MAGNETISM

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO EVALUATE THE SOCIAL EFFECT OF ELECTRICITY (OR ANY SCIENTIFIC ACHIEVEMENT) BY IDENTIFYING WHETHER THE ADVENT OF ELECTRICITY IS INHERENTLY GOOD OR BAD, BOTH OR NEITHER. 241

Which of the choices below best represents the true meaning of the age of electricity to our society? 4400651

a. the average citizen only needs to push a few buttons for a few hours a day, and then home to leisure.
*b. electricity is neither good nor bad by itself, but proper choices must be made among the enormous possibilities it opens up.
c. electricity has enabled our population to migrate from urban to rural areas.
d. electricity has only created a demand for more and more material possessions causing a rift in our society.

Source: Project Physics, ch. 15.

THE STUDENT WILL DISPLAY HIS ABILITY TO RECALL THE FACTS INVOLVING CHANGES INSIDE A HOLLOW SPHERE BY RECOGNIZING THE CAUSES FOR THE EFFECTS AND WHO DISCOVERED THEM FROM A SERIES OF CHOICES. 227

The reason electrical force inside a charged hollow sphere sums to zero is 4400626

*a. electric force law is an inverse square law.
b. electrical charges of the same sign repel.
c. electrical charges of the opposite sign attract.
d. the electrical force is proportioned to the distance.

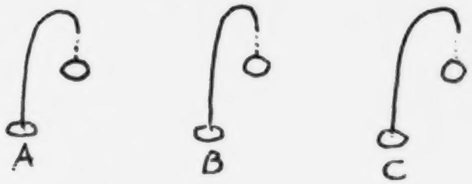
Who first showed the summation of the electric forces inside a hollow sphere was zero? 4400627

a. Newton
* b. Coulomb
c. Gilbert
d. Priestley
e. Franklin

Source: Project Physics, ch. 14.3

THE STUDENT SHALL DEMONSTRATE HIS ABILITY TO ANALYZE AN EXPERIMENT BASED ON COULOMBS LAW BY SELECTING APPROPRIATE CONCLUSIONS. 230

Directions: The 3 identical metal covered spheres pictured below are in an unknown state of charge. Based on the results of simple experimental tests given, choose the best answer to show what the experimenter can definitely hypothesize.



When sphere A and B are brought near, they are mutually attracted. This means that 4400631

a. A and B have like charges.
b. A and B have unlike charges.
c. Either A or B is charged, the other being neutral.
d. All three of the above answers are true (a, b, & c).
*e. Either answer "b" or "c" could be true

Upon bringing spheres B and C near each other, they also exhibit mutual attraction. This further shows that 4400632

a. B and C may have unlike charges.
b. B could be uncharged.
c. A and B could both be charged.
d. B and C could both be charged.
*e. All answers are individually possible.

Keeping in mind the results of #1 and #2, spheres A and C are brought near and are also found to exhibit mutual attraction. We are now able to know that 4400633

a. A and C are of unlike charge.
*b. One of the spheres is definitely uncharged.
c. A and B are both charged.
d. B and C have unlike charges.
e. A, B, and C all have unlike charges.

Suppose in #3 that A and C had been mutually repelled. Remembering results from #1 and #2 we now can be certain that 4400634

a. all three were initially charged.
b. one sphere is not charged.
*c. A and C have like charges.
d. A and B have unlike charges.
e. B and C have unlike charges.

Source: Project Physics, ch. 14.4

THE STUDENT WILL EXHIBIT HIS ABILITY TO COMPREHEND THE IDEAS OF A FIELD BY IDENTIFYING THEIR MEANINGS WHEN PRESENTED. 231

The meaning of "field" as used by physicists is 4400635

a. the value of the field at a point in space.
b. the collection of all values.
c. a region of space where there are values.
*d. all of the above
e. none of the above

Source: Project Physics, ch. 14.4 p. 47.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO COMPREHEND ELECTRICAL POTENTIAL BY IDENTIFYING ITS CHARACTERISTICS AND UNITS. 232

The electrical potential refers to which of the following? 4400636

a. voltage
b. energy
c. work
d. joules
*e. all the above

Voltage is measured in which of the following units? 4400637

a. coulombs/sec.
b. joule/sec.
c. volts/meter
*d. joules/coulomb
e. coulombs/second

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO COMPREHEND HOW ENERGY DISSIPATION VARIES WITH ELECTRICAL CURRENT BY IDENTIFYING THE CORRECT RELATIONSHIP. 234

If the current in a conductor is doubled, how does the rate of heat dissapation change? 4400641

a. $\frac{1}{4}$ as fast
b. $\frac{1}{2}$ as fast
c. twice as fast
*d. four times as fast
e. the same

Source: Project Physics, ch. 14.10

THE STUDENT WILL DEMONSTRATE HIS COMPREHENSION OF THE DEPENDENCE OF POTENTIAL DIFFERENCE AND ELECTRICAL CURRENT BY IDENTIFYING THE RELATIONSHIP. 236

When the potential difference between the ends of a metal conductor is doubled, the current will be 4400643

a. $\frac{1}{2}$ the original current.
b. the same as the original current.
c. 3/2 the original current.
*d. 2 times the original current.
e. 4 times the original current.

Source: Project Physics, ch. 14.9

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO ANALYZE PROPERLY THE EVENTS LEADING TO THE USE OF AC RATHER THAN DC IN THIS COUNTRY BY SELECTING THE CHIEF UNDERLYING REASON FOR THIS. 240

In the controversy of AC vs DC for the first hydroelectric plant at Niagara Falls, the decision for AC was primarily due to 4400650

a. Thomas Edison's influence.
b. the fact that the falls supplied a cheap power source.
c. a large prize was offered for a successful system.
*d. a demonstration in Germany using AC.
e. the ease of using AC over DC.

Source: Project Physics, ch. 15,8

THE STUDENT WILL DISPLAY HIS ABILITY TO COMPREHEND THE WAY FORCES ARE PRODUCED ON CHARGED BODIES AS THEY MOVE IN MAGNETIC FIELDS BY IDENTIFYING THE CORRECT PREDICTIONS FROM STATED CONDITIONS. 233

A charged body moves parallel to the direction of a magnetic field. Which of the following represents the force resulting on the body? 4400638

a. It acts in the same direction the body moves.
b. It acts in the opposite direction the body moves.
c. It acts at right angles to the body's motion.
d. It acts at right angles to both the body's motion and the direction of the magnetic field.
*e. There is no resultant force.

Which of the following do not affect the magnitude of the force of a charged object moving through a magnetic field? 4400639

*a. the velocity's component parallel to the field.
b. the velocity's component perpindicular to the field.
c. the strength of the magnetic field.
d. the size of the charge on the body.
e. the path of the body through the field.

Which of the choices in item #2 affect the direction of the force on the charged object? 4400640

a. all of the above
b. a, b, c.
*c. b, c, e
d. b, c, d, e
e. b, c, d

Source: Project Physics, ch. 14.

THE STUDENT WILL EXHIBIT HIS ABILITY TO RECALL THE HISTORY OF THE ELECTRIC LIGHT BULB BY IDENTIFYING PEOPLE AND PROCESSES THAT MADE IT POSSIBLE. 239

From the following list, whose contribution was essential to the development of the incandescent lamp? 4400647

a. Edison
b. Davy
*c. Sprengel
d. Crookes
e. Faraday

Which device made Edison's carbon filament obtain a useful life? 4400648

a. the dynamo
b. the battery
c. the glass enclosure
*d. a good vacuum pump
e. the arc lamp

In order for Edison's parallel hook-up system to work so that individual lamps could be controlled, the filament of his lamps needed which property listed? 4400649

*a. high resistance
b. high strength
c. low flammability
d. high density
e. high ductility.

Source: Project Physics, ch. 15.7

THE STUDENT WILL EXHIBIT HIS ABILITY TO RECALL WHO DID THE EARLIEST WORK ON MAGNETIC FIELDS BY SELECTION FROM A LIST OF EARLY EXPERIMENTERS AND PHILOSOPHERS. 226

The ideas of a field to explain magnetic effects were first suggested by 4400625

a. Newton
b. Galileo
c. Lucretius
*d. Gilbert
e. Franklin

THE STUDENT WILL DISPLAY HIS ABILITY TO RECALL THE CONDITIONS UNDER WHICH ELECTRIC CHARGES AFFECT MAGNETS BY THE IDENTIFICATION OF THESE CONDITIONS. 235

What conditions must be met so that a magnet would be affected by electric charges? 4400642

a. They should be in close proximity.
b. The magnet itself could be moving.
c. The electrical charges should be moving.
d. The movement between the two should be sideways.
*e. All of the above may be valid conditions.

Source: Project Physics, ch. 14.11.

THE STUDENT WILL DISPLAY HIS KNOWLEDGE OF ELECTROMAGNETIC INDUCTION BY RECOGNIZING EXAMPLES OF IT. 237

Electromagnetic induction is used in which of the following instances? 4400644

*a. an automobile generator
b. an electric motor
c. a magnetic stirrer
d. all of these
e. none of these

In which of these cases does electromagnetic induction not occur? 4400645

a. a current is started in a wire held near a loop of wire.
b. a current is stopped in a wire held near a loop of wire.
c. a magnet is moved through a loop of wire.
*d. a loop of wire is held in a steady magnetic field.
e. a loop of wire is moved across a magnetic field.

Source: Project Physics, ch. 15.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO EVALUATE THE RESULTS OF FARADAYS MAGNETIC FIELD DISCOVERY BY IDENTIFYING THE MOST IMPORTANT AFTERMATH OF THESE RESULTS. 238

Faraday, by his discovery that the magnetic lines of force produced by a current carrying wire were circular, demonstrated most importantly to the scientific community that: 4400646

a. Newton's laws do not apply to magnetic forces.
b. that mathematical approaches to problems are the best.
c. that Andre Ampere was wrong about magnetic forces.
*d. that intuition and experimental results could produce important discoveries.
e. that it is obvious that forces are mutually affective between magnetism and electricity.

Source: Project Physics, ch. 15.3

GASES

THE STUDENT WILL EXHIBIT ABILITY TO DISTINGUISH BETWEEN SEVEN COMMON GASES FOUND IN THE LABORATORY BY IDENTIFYING A GAS BASED ON OBSERVATION AND EXPERIMENTATION. 244

Based on the following description of observations and experimentation identify the gas that satisfies the description. 4400656

The gas is colorless, highly soluble in water, and changes red litmus to blue.
The gas is ___________

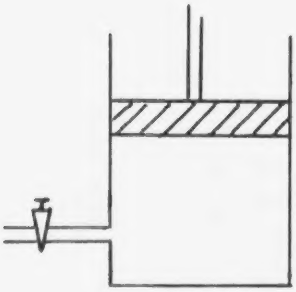
a. hydrogen chloride
b. chlorine
*c. ammonia
d. hydrogen
e. nitric oxide

The gas is colorless, has low solubility in water, and turns reddish brown when stopper is removed to attempt glowing splint test. 4400657

a. nitrogen dioxide
b. chlorine
c. hydrogen
*d. nitric oxide
e. ammonia

Source: Raytheon Chemistry, p. 5-6.

THE STUDENT WILL RECOGNIZE REGULARITIES IN GAS BEHAVIOR WHEN THESE REGULARITIES ARE PRESENTED IN THE FORM OF VERBAL STATEMENTS OR GRAPHS BY PREDICTING WHAT CHANGE WILL TAKE PLACE WHEN A GIVEN OCCURRENCE TAKES PLACE. 2



The diagram at the left represents a closed cylinder with a moveable piston. Gas can be added or removed. The cylinder and its contents can be heated or cooled. Pressure, temperature, volume, and amount of gas present can all be measured.

As additional gas is added to the cylinder with the piston free to move, which of the following changes will occur? 4400004

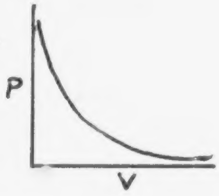
a. Pressure will increase
*b. Volume will increase
c. Temperature will increase
d. All of the above

If the amount of gas and temperature are held constant, what will happen to pressure when the piston is pushed down? 4400005

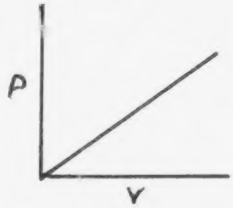
*a. Increase
b. Remain the same
c. Decrease

Which graph best shows how pressure will change as the piston is pushed down? 4400006

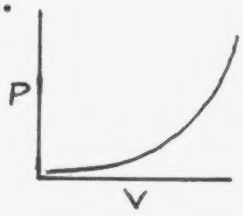
*a.



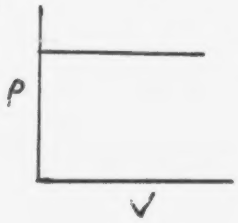
b.



c.



d.



If the piston were locked in place, how might one increase pressure? 4400007

*a. Heat the cylinder.
b. Allow gas to flow out of the cylinder.
c. Replace the gas with an equal number of moles of denser gas.
d. Use a larger pressure guage.

Source: Chemistry: Experiments and Principles, pages 55-59.

THE STUDENT WILL BE ABLE TO INTERPRET MACROSCOPIC MODELS OF GASES IN TERMS OF THE KINETIC THEORY BY SELECTING THE PROPER MODEL IN A GIVEN INSTANCE. 3

Moving balls on a pool table are sometimes used as a two dimensional model for a gas.

What is the greatest objection to this model? 4400008

a. The balls frequently collide with one another.
*b. The balls slow down.
c. The balls move with different speeds.
d. The balls all have nearly the same mass.

In this model the pool table would be most similar to 4400009

a. A balloon.
b. A cylinder with movable piston.
c. The entire universe.
*d. A rigid steel container.

To show a temperature increase, one would 4400010

a. use bigger balls.
b. use more balls.
*c. make the balls move faster.
d. place one's cigarette on the edge of the pool table.

To show a pressure increase, one would 4400011

a. use more balls.
b. make the balls move faster.
*c. either a or b.
d. neither a or b.

Chemistry: Experiments and Principles, pages 59-62.

THE STUDENT CAN EVALUATE FACTORS THAT ACT TO CHANGE THE STATE OF GASEOUS SYSTEM BY MAKING QUANTITATIVE ESTIMATES OF THEIR RELATIVE IMPORTANCE. 9

100 liters of helium is placed in a weather balloon having a capacity of 1,000 liters. Ground temperature is 27°C and ground pressure is 740 torr. When the balloon ascends, it bursts at an altitude of 20,000 meters. The temperature at this altitude is -23°C.

Which of the following factors most probably caused the balloon to burst? 4400024

a. Excessive diffusion of helium through the balloon wall.
b. The decrease in temperature with increasing altitude.
*c. The decrease in atmospheric pressure with increasing altitude.
d. The gravitational pull of the sun.

If the balloon had been placed in a ground level freezer at -23°C the volume of the helium would be expected to 4400025

a. drop to almost 0
*b. drop to 83.3 liters
c. stay at 100 liters
d. rise to 120 liters

The volume of the helium at an altitude of 20,000 meters and a temperature of -23°C is 4400026

a. almost 0
b. 10 liters
c. 100 liters
*d. 1,000 liters

On the basis of the data given here, atmospheric pressure at 20,000 meters is approximately 4400027

a. 0
*b. 63 torr
c. 187 torr
d. 740 torr

Chemistry: Experiments and Principles, pages 57-59.

THE STUDENT WILL BE ABLE TO RECOGNIZE CONDITIONS UNDER WHICH REAL GASES MOST NEARLY APPROXIMATE THE IDEAL GAS BY SELECTING THE CORRECT CONDITION IN GIVEN SITUATIONS. 44

Under which of the following sets of conditions is hydrogen closest to being an ideal gas? 4400032

a. 380 mm & 25°C
*b. 380 mm & 100°C
c. 760 mm & 25°C
d. 760 mm & 100°C

Chemistry: Experiments and Principles, Ch. 4.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF DALTONS LAW BY CALCULATING PARTIAL PRESSURES. 12

4 moles of X and 6 moles of Y are injected into a container. The total pressure of the container is 500 torr.

Which of the following equations could be solved to determine the partial pressure (P) of X? 4400033

*a. $P + \frac{6}{4} P = 500$
b. $P + \frac{4}{6} P = 500$
c. $\frac{6}{4} P - 500 = P$
d. $500 - \frac{4}{6} P = P$

What is the partial pressure of X? 4400034

a. 100 torr
*b. 200 torr
c. 300 torr
d. 500 torr

Experiments and Principles, p. 56.

GIVEN AN UNKNOWN GAS AND EXPERIMENTAL DATA, THE STUDENT WILL APPLY HIS UNDERSTANDING OF AVOGADRO'S HYPOTHESIS BY SELECTING 1) THE CORRECTLY CALCULATED MOLE MASS OF THE GAS, AND 2) THE CORRECTLY WRITTEN EMPIRICAL AND MOLECULAR FORMULA. 60

Given the following experimental data

container ± hydrogen gas	60.04 g.
container + unknown gas	60.38 g.
container empty	60.02 g.

The unknown gas analyzed was found to contain 20% hydrogen and 80% carbon.

The mole mass of the gas is 4400157

a. .36 g.
*b. 36 g.
c. .02 g.
d. 2 g.

The empirical formula is 4400158

*a. CH_3
b. CH_4
c. C_2H_6
d. C_3H_8

The molecular formula is 4400159

a. CH_3
b. CH_4
*c. C_2H_6
d. C_3H_8

THE STUDENT WILL BE ABLE TO APPLY THE PV EQUALS K RELATIONSHIP BY CALCULATING EITHER THE PRESSURE OR VOLUME OF A GAS AFTER A CHANGE IN CONDITIONS HAS BEEN MADE. 74

A sample of a gas exerts a pressure of 1.43 atm. with a volume of 32.4 liters. In order to increase the pressure of 1.74 atm. the volume would have to change. The new volume at the same temperature would be found by 4400179

*a. $\frac{1.43 \text{ atm} \times 32.4 \text{ l}}{1.74 \text{ atm}}$

b. $\frac{1.74 \text{ atm} \times 32.4 \text{ l}}{1.43 \text{ atm}}$

c. $\frac{1.74 \text{ atm} \times 1.43 \text{ atm}}{32.4 \text{ l}}$

d. $\frac{32.4 \text{ l}}{1.74 \text{ atm} \times 32.4 \text{ atm}}$

e. $\frac{1.43 \text{ atm}}{1.74 \text{ atm} \times 32.4 \text{ l}}$

THE STUDENT WILL APPLY HIS UNDERSTANDING OF THE PRESENCE OF SUB-UNITS, ATOMS, IN THE MOLECULES OF A GAS BY INDICATING PROPERTIES THAT ARE DUE TO MOLECULES IN GENERAL AS OPPOSED TO PROPERTIES OF MOLECULES THAT HAVE A SPECIFIC KIND OF ATOM IN THEM. 75

In the statements below, answer a if the statement is a property of all molecules, b if it is a property of molecules containing specific kinds of atoms, or c if it is a property of both.

_a_ Gases expand to fill a container. 4400180

_b_ Gases are usually colorless. 4400181

_a_ Gases expand when heated. 4400182

_c_ Gases are soluble in water. 4400183

_b_ Gases react with metals on heating. 4400184

THE STUDENT WILL BE ABLE TO APPLY LECHATELIERS PRINCIPLE BY PREDICTING THE RESULT OF CERTAIN CHANGES MADE ON A GIVEN SYSTEM. 79

The following situation is to be used in answering the questions.

In a closed container, the following equilibrium has been established.

$$24 \text{ Kcal} + 2\, NH_{3(g)} \rightleftarrows N_{2\,(g)} + 3\, H_{2\,(g)}$$

Select from the following list the change or changes that will occur if the pressure on the sy stem is increased. 4400191

a. The concentration of $N_{2(g)}$ will increase.

b. The concentration of $H_{2(g)}$ will increase.

*c. The concentration of $NH_{3(g)}$ will increase.

d. Both a and b above.

e. None of the above.

Which of the following changes will occur if the temperature is increased? 4400192

a. The concentration of $N_{2(g)}$ will increase.

b. The concentration of $H_{2(g)}$ will increase.

c. The concentration of $NH_{3\,(g)}$ will increase.

*d. Both a and b above.

e. None of the above.

Using the principles of equilibrium, which of the following will happen if coho salmon are indefinitely stocked in Lake Michigan? 4400193

*a. The die off rate for coho will increase.
b. The coho population will increase indefinitely.
c. The total fish population will increase indefinitely.
d. Both b and c above.
e. None of the above.

A glass of iced tea, after vigorous stirring, still has some undissolved sugar on the bottom of the glass. Using the following equation (and the principles of equilibrium), predict what changes will make the tea sweeter. 4400194

$$\text{Energy} + \text{Tea}_{(aq)} + \text{Sugar}_{(s)} \rightleftarrows \text{Sweet Tea}_{(aq)}$$

a. adding still more sugar to the tea.
*b. warming the tea.
c. increasing the pressure on the tea.
d. drinking some tea.
e. add a catalyst.

You are in the business of making liquid air from gaseous air. Which of the following conditions would be most important to control? 4400195

a. temperature
*b. pressure
c. concentration of N_2
d. concentration of O_2
e. catalysts

THE STUDENT WILL BE ABLE TO PREDICT THE FORMULA OF AN UNKNOWN GAS GIVEN INFORMATION ABOUT ITS WEIGHT AS COMPARED TO THE WEIGHT OF OXYGEN BY SELECTING ITS PROBABLE COMPOSITION FROM A LIST. 93

A glass bulb weighs 136.00 g when evacuated. A sample of gas from a sewer treatment plant is placed in the bulb at one atmosphere pressure and found to weigh 137.65 grams. When the same glass bulb is filled with oxygen at one atmosphere pressure it is found to weigh 139.2 grams. This gas is probably composed of 4400219

a. SO_2
b. CH_4
c. NH_3
*d. a mixture of CH_4 and NH_3
e. a mixture of SO_2, NH_3, and CH_4

THE STUDENT WILL BE ABLE TO ANALYZE THE RESULTS OF AN EXPERIMENT INVOLVING EQUAL AMOUNTS OF GASES BY SELECTING THE ASSUMPTION THAT CAN BE DRAWN FROM THE EXPERIMENT. 94

A student determines the mass of 10.1 of methane gas and the mass of 10.1 of freon gas at the same pressure and temperature. The freon weighs about 50 grams and the methane only 6.4 grams. The student can account for this difference by assuming 4400220

a. freon particles weigh more and there are more of them.
b. freon particles weigh more and there are less of them.
c. freon particles weigh more and there are the same number of them.
d. freon particles weigh the same as methane but there are more of them.
*e. any one of the above.

THE STUDENT WILL APPLY THE PRINCIPLES OF AVOGADROS LAW BY CORRECTLY RECOGNIZING CORRELATED ANALOGIES IN AN ANALOGOUS SITUATION. 95

Two neighboring high schools decide to hold a joint dance where only couples can attend and each couple must be made up of a boy from one school and girl from the other. Girls can ask boys if necessary. The dance was an outstanding success since every student attended. Which alternatives of the following must be true? 4400221

*a. There are equal numbers of boys and girls in each school.
b. One school is all boys and the other is all girls.
c. There are different numbers of boys and girls in each school.
*d. The total number of students is the same in each school.
e. The total number of boys and girls is different in each school.

GIVEN INFORMATION ON THE MASS OF A VOLUME OF KNOWN GAS, THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF AVOGADROS LAW BY PREDICTING THE RELATIVE WEIGHT OF AN UNKNOWN GAS. 96

Two liters of a gas A are found to have a mass of 4.50 grams. Two liters of gas B, assigned weight 20, at the same conditions, is found to have a mass of 1.50 grams. Using Avogadro's Hypothesis, predict the relative weight of gas A. 4400222

*a. 60
b. 90
c. 135
d. 6.66
e. 30

THE STUDENT WILL APPLY AVOGADROS HYPOTHESIS BY SELECTING THE VOLUME A GIVEN GAS WILL OCCUPY FROM INFORMATION ABOUT AN EQUAL MASS OF A KNOWN GAS. 104

If twenty grams of SO_2 (g) at 37°C and 1.26 atm occupies a volume of 8.0 l, the volume that would be occupied by 20 grams of methane, CH_4, under the same conditions would be 4400237

a. 8.0 l.
b. 4.0 l.
c. 2.0 l.
*d. 32.1.
e. 64 l.

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF AVOGADROS NUMBER AND GAS LAW (AVAGADRO CONSTANT) BY CORRECTLY SOLVING PROBLEMS CONCERNING IT. 133

The number of molecules of water that would be produced is 4400335

a. 1.12×10
b. 2.24×10^4
*c. 3×10^{23}
d. 6×10^{23}
e. 12×10^{23}

The number of atoms of hydrogen that would react would be 4400336

a. 2.24×10^4
b. 3×10^{23}
*c. 6×10^{23}
d. 12×10^{23}
e. 24×10^{23}

If 16 g of oxygen react, how many liters of water are formed? 4400337

a. 5×10^{-1}
b. 1
c. 2.24
*d. 2.24×10
e. 4.48×10

Source: Chemistry Experiments & principles, p. 23, Raytheon Publications.

GIVEN INFORMATION ON THE COMBINING VOLUME RATIOS OF GASES, THE STUDENT WILL DETERMINE THE PROPER DISTRIBUTION OF ATOMS IN A MOLECULE BY CORRECTLY SELECTING THE DISTRIBUTION OF ATOMS FOR EACH GAS FROM A LIST. 97

One volume of gas A is found to react with three volumes of gas B to form two volumes of gas C. The number of atoms in each must be 4400223

a. odd in A, even in B, and even in C.
b. odd in A, odd in B, and odd in C.
*c. even in A, even in B, and even in C.
d. even in A, even in B, and odd in C.
e. none of the above.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF TEMPERATURE PRESSURE VOLUME RELATIONSHIPS OF GASES BY SELECTING CORRECTLY CALCULATED MOLAR MASSES OF GIVEN GASES. 131

If one liter of NO_2 has a mass of 2.0 g. and one liter of an unknown gas has a mass of 1.59g., what is the molar mass of the unknown gas? 4400331

a. 16
b. 23
c. 32
*d. 36.5
e. 46

If one liter of oxygen has a mass of 1.39 g., what would you expect to be the mass of 1 L. of neon gas? 4400332

a. 6.1×10^{-1} g.
*b. 8.7×10^{-1} g.
c. 1.22 g.
d. 1.59 g.
e. 1.74 g.

Source: Chemistry: Experiments & Principles, p. 26, Raytheon Publications.

THE STUDENT SHOWS KNOWLEDGE OF THE MEANING OF EQUATIONS AND MOLAR MASSES AND GAS LAWS BY SELECTING THE CORRECTLY CALCULATED VOLUMES OR MASSES OF REACTANTS AND PRODUCTS IN REACTIONS INVOLVING GASES OR SOLIDS. 132

The volume of gas produced in the reaction of hydrogen and oxygen at STP to produce water if ½ mole of hydrogen is available is: 4400333

a. 1L
b. 2L
*c. 1.12 x 10L
d. 2.24 x 10L
e. 4.48 x 10L

The mass of water produced in the above is: 4400334

a. 2g.
*b. 9g.
c. 1.6 x 10g
d. 1.8 x 10g
e. 3.6 x 10g

Source: Chemistry: Experiments & Principles, p. 23, Raytheon Publications

THE STUDENT WILL RECALL THE CONDITIONS OF STANDARD TEMPERATURE AND PRESSURE BY STATING THE VALUES OF EACH. 246

The internationally accepted values or standard temperature and pressure are 4400659

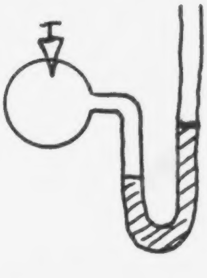
a. 32°C and 1 atm
*b. 0°C and 760 mm
c. 0°F and 1 atm
d. 32°F and 760 atm
e. none of these

Source: Raytheon Chemistry, p. 7.

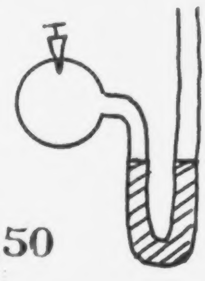
THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE USE OF BOTH THE OPEN AND CLOSED MANOMETER BY IDENTIFYING THE DIAGRAM THAT BEST REPRESENTS A GIVEN MEASUREMENT OF GAS PRESSURE. 247

The diagram which best shows a gas pressure of 380 mm using an open manometer is 4400660

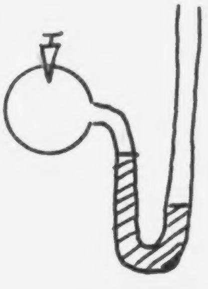
a.



b.

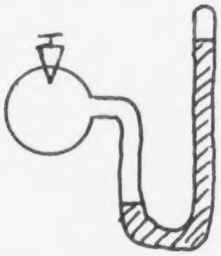


*c.

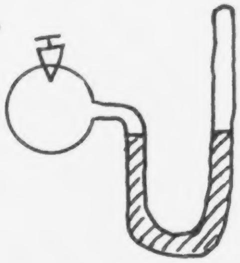


The diagram which shows a gas pressure of 2 atm using a closed manometer is 4400661

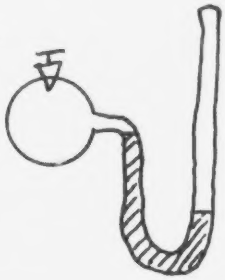
*a.



b.



c.



Source: Raytheon Chemistry, p. 7.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE MODEL OF A CONFINED GAS BY PREDICTING A "REAL" MODEL THAT COULD REPRESENT A CONFINED GAS AND THE EFFECT A CHANGE OF CONDITION WOULD HAVE ON THE MODEL. 248

Using the plastic box containing ball bearings as a logical model of a confined gas, which of the following will increase gas pressure? 4400662

a. use larger box
b. use larger size ball bearings
*c. shake box more rapidly
d. remove lid of box
e. remove several ball bearings

Which of the following best represents a logical model of a confined gas? 4400663

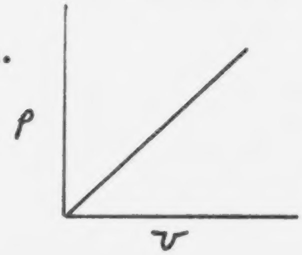
a. a cup of sand in 1 lb. coffee can
b. wood cubes in shoe box
c. rocks in a clear plastic bag
*d. BB's in quart mason jar
e. marbles in a shoe box

Source: Raytheon Chemistry, p. 8-10.

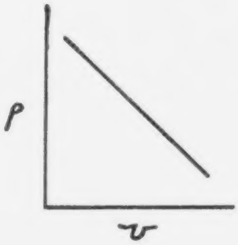
THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF THE PRESSURE VS. VOLUME RELATIONSHIP OF A GAS BY DETERMINING THE PROPER GRAPHICAL REPRESENTATION OF THE RELATION. 249

Which of the following graphs illustrates the proper pressure-volume relationship? 4400664

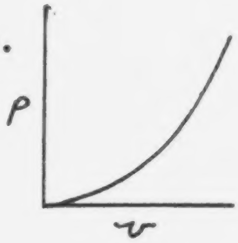
a.



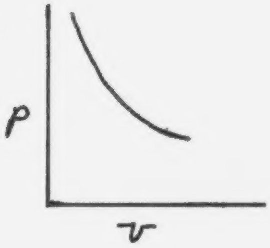
b.



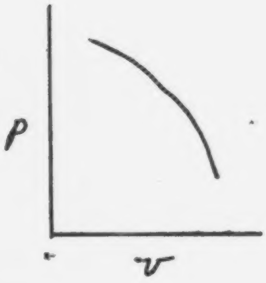
c.



*d.



e.



Source: Raytheon Chemistry, p. 11.

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF ADVOGADROS HYPOTHESIS RELATIVE TO MOLECULAR MASS BY PREDICTING THE MASS OF A MOLECULE OF A GAS, GIVEN THE MASS OF A KNOWN VOLUME OF ANOTHER GAS AND THE MASS OF ITS MOLECULE. 253

At STP, 1 liter of ammonia gas weighs 0.76 grams. What is the mass of an ammonia molecule relative to the mass of an oxygen molecule (mass 32) if 22.4l of oxygen at STP weighs 32g? 4400671

a. 41.8
*b. 17.0
c. 24.3
d. 34.0
e. 16.0

One liter of Hydrogen chloride gas weighs 1.49g, while 1 liter of Carbon dioxide weighs 1.81g measured at room temperature and 1 atmosphere pressure. If the mass of a hydrogen chloride molecule is 36.5, the mass of a molecule of carbon dioxide will be: 4400672

a. 36.5
b. 30.0
c. 46.0
*d. 44.0
e. 28.0

Source: Raytheon Chemistry, p. 26.

THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF THE VOLUME VS. TEMPERATURE RELATIONSHIP OF A GAS BY CALCULATING THE SOLUTION TO PROBLEMS WHERE THE VOLUME IS DIRECTLY PROPORTIONAL TO THE ABSOLUTE TEMPERATURE AT CONSTANT PRESSURE. 264

10 liters of a gas are heated from 27°C to 127°C. The new volume of the gas at the same pressure will be 4400692

a. 5.0 liters
b. 7.5 liters
*c. 13 liters
d. 21 liters
e. 47 liters

The volume of a gas measured at STP is found to be 20 liters. At the same pressure and after heating the volume is 40 liters. The new temperature is 4400693

a. 273°K
b. 373°K
c. 187°K
*d. 546°K
e. 136°K

Source: Raytheon Chemistry, pp. 56-58.

THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF THE PRESSURE VS. TEMPERATURE RELATIONSHIP OF A GAS BY CALCULATING THE SOLUTION TO PROBLEMS WHERE THE PRESSURE OF A GAS IS DIRECTLY PROPORTIONAL TO THE TEMPERATURE AT A CONSTANT VOLUME. 265

The temperature of a gas in a 10 liter steel tank was increased from 77°C at 1 atm. pressure to a temperature of 427°C. The new pressure is 4400694

a. 0.5 atm.
*b. 2.0 atm
c. 50 atm
d. 200 atm
e. 350 atm

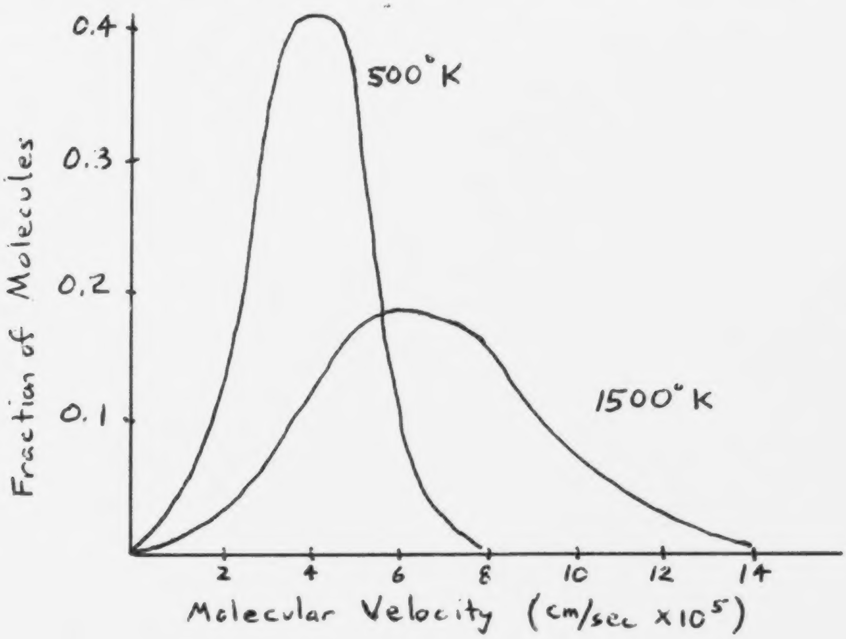
The reading of the pressure gauge on a gas storage cylinder changed from 200 atmospheres at 68°F to 186 atmospheres. The temperature of the tank is now 4400695

a. 105°F
b. 62°F
c. 86°F
d. 156°F
*e. 32°F

Source: Raytheon Chemistry, pp. 58-59.

THE STUDENT WILL BE ABLE TO SHOW HIS COMPREHENSION OF THE ROTATING DISC EXPERIMENT OF MOLECULAR VELOCITIES BY IDENTIFYING PROPER INTERPRETATIONS OF A GRAPH BASED ON DATA FROM THE ROTATING DISC EXPERIMENT. 268

The following graph shows molecular velocity distribution for tin at two temperatures.



Identify the statement regarding molecular velocity which is not validated by experimental data. 4400699

a. a few molecules have a high velocity.
b. most molecules have intermediate velocities.
c. the lower the temperature the narrower the distribution of velocities.
d. the curve flattens out as the average temperature is increased.
*e. the average velocity is at the peak because the curves are symetrical.

Source: Raytheon Chemistry, pp. 63-64.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF THE LAW OF PARTIAL PRESSURES TO SELECT THE PROPER SOLUTION TO PROBLEMS INVOLVING THE PARTIAL PRESSURES EXERTED BY MULTIPLE GASES. 262

Start with 3 atmospheres pressure of oxygen and 1 atmosphere pressure of nitrogen in separate identical vessels. Opening the stopcock between the vessels will result in the oxygen gas exerting a partial pressure of 4400689

a. 3 atm.
b. 2.5 atm.
c. 2.0 atm.
*d. 1.5 atm.
e. 1.0 atm.

A tank contains 2 moles of N_2 gas, 3 moles of O_2 gas, and 1 mole of CO_2 gas. The total pressure in the tank is 1500mm. The partial pressure due to N_2 gas is 4400690

a. 250 mm
*b. 500 mm
c. 750 mm
d. 1000 mm
e. 1250 mm

Source: Raytheon Chemistry, pp. 55-6.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO COMPREHEND THE KINETIC THEORY OF GASES BY LOCATING THAT STATEMENT FROM A PARAGRAPH DESCRIBING THE KINETIC THEORY OF GASES WHICH BEST STATES THE CONCEPT. 263

1.The molecules of a gas, even at room temperature are in rapid motion. 2 They collide with the container walls and with other gas molecules many times each second. At any one instant some molecules experience head-on collisions. Other molecules collide in a glancing manner. 3 We would expect the direction a molecule is moving to change many times per second. 4 In addition, energy is transferred from one molecule to another during a collision. A fast moving molecule suddenly is slowed down. Then an instant later, after another collision, the molecule may gain energy and speed up again. 5 We would expect gas molecules because of collisions to travel in all directions and with different velocities.

From the above paragraph select the underlined numbered statement which best describes the behavior of a gas molecule. 4400691

a. 1
b. 2
c. 3
d. 4
*e. 5

MOLES

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE DEFINITION OF MOLAR VOLUME BY CHOOSING SUITABLE UNITS FOR THIS QUANTITY. 1

Which set of units would be suitable for molar volume? 4400001

a. grams/liter
b. moles/liter
*c. liters/mole
d. grams/mole

The density of solid aluminum is 2.7 grams/ml. What is the molar volume of aluminum in units of ml/mole. 4400002

a. 100
*b. 10
c. 1
d. 0.1

At a temperature of $0^{o}C$ and a pressure of 1 atmosphere, 1 mole of an ideal gas occupies 4400003

*a. 22.4 liters
b. 24.5 liters
c. 144 liters
d. 6.0×10^{23} liters

Chemistry: Experiments and Principles, pages 65-66.

THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF MOLAR MASS AND MOLAR VOLUME BY SOLVING MASS-VOLUME AND VOLUME-VOLUME PROBLEMS IN THE FORM OF A BALANCED EQUATION. 7

When hydrochloric acid is spilled on a piece of marble, the following reaction occurs:

$$CaCO_3\ (s) + 2\ HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O$$

The $CaCl_2$ formed in this reaction is collected, dried, and found to weigh 44.4 g.

What volume of CO_2 (measured at room conditions) would form in this reaction? 4400020

*a. 9.8 l
b. 22.4 l
c. 24.5 l
d. 602 l

Which of the following does the student not need to know in order to solve this problem? 4400021

a. Molar mass of $CaCl_2$
*b. Molar mass of CO_2
c. Molar volume of CO_2
d. Coefficients of the balanced equation.

Chemistry: Experiments and Principles, p. 70.

THE STUDENT WILL DEMONSTRATE A KNOWLEDGE OF THE CONCEPT MOLAR MASS WHEN GIVEN THE MASS OF EQUAL VOLUMES OF A KNOWN AND UNKNOWN GAS, BY DETERMINING THE MOLAR MASS OF THE UNKNOWN GAS. 8

An evacuated flask weighs 147.34 g. The flask is filled with oxygen and found to weigh 147.98 g. The flask is again evacuated and is refilled with an unknown gas at the same temperature and pressure as the oxygen. The flask now weighs 148.94 g.

Which of the following need not be calculated in order to determine the molar mass of the unknown gas? 4400022

a. Mass of oxygen
b. Mass of the unknown gas
c. Molar mass of oxygen
*d. Volume of the flask

What is the molar mass of the unknown gas? 4400023

a. 32 grams/mole
*b. 80 grams/mole
c. 160 grams/mole
d. Impossible to determine from the facts given

Chemistry: Experiments and Principles, pages 25-26

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF MOLAR MASSES BY CALCULATING CHEMICAL ATOMIC MOLAR MASSES FROM MASS SPECTROGRAPHIC DATA. 15

Which of the following must be determined from the mass spectrum of chlorine in order to calculate its atomic molar mass? 4400039

a. charge to mass ratio for each ion
*b. per cent abundance of each isotope
c. the ionization energy for chlorine
d. pressure of each isotope in the ionization chamber

75% of the chlorine atoms found in nature have a molar mass of 35.0 and 25% have a molar mass of 37.0. What is the chemical molar mass for chlorine? 4400040

*a. 35.5
b. 36.0
c. 36.5
d. Impossible to determine from the given information.

Chemistry: Experiments and Principles, pp. 411-412.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF MOLARITY BY SELECTING THE CORRECTLY CALCULATED GRAM OR LETTERED MEASUREMENT IN A GIVEN PROBLEM. 48

How many grams of HCl are needed to prepare 2 liters of 0.20 M solution? 4400142

a. 36.5 g.
b. 3.65 g.
c. 73 g.
*d. 7.3 g.

Given 2.24 liters of HCl gas, how many liters of 0.05 M solution can be formed? 4400143

a. .12 liter
b. .2 liter
*c. 2 liters
d. 1.2 liters

O'Conner et al Chemistry: Experiments and Principles

GIVEN A NUMBER OF GRAMS OF AN ELEMENT, THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF MOLES BY SELECTING THE CORRECT NUMBER OF MOLES FOR THAT ELEMENT. 55

How many moles of Al in 54 grams of Al? 4400152

a. 1
*b. 2
c. 3
d. 4

GIVEN THE PERIODIC CHART, THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF THE MOLAR MASS OF A SUBSTANCE BY SELECTING THE CORRECTLY CALCULATED GRAM WEIGHT FOR THAT SUBSTANCE. 56

From the periodic chart give the molar mass of Mg_3PO_4 4400153

a. 71 g.
b. 119 g.
*c. 167 g.
d. 260 g.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF MOLE RELATIONSHIP EXPRESSION IN EQUATIONS BY SELECTING THE CORRECTLY CALCULATED NUMBER OF MOLES IN A CHEMICAL EQUATION. 58

Given the equation

$$2Na_{(s)} + 2H_2O_{(l)} \longrightarrow 2Na^+_{(aq)} + 2OH^-_{(aq)} + H^0_{2(g)}$$

How many moles of $H_2^0{}_{(g)}$ can be prepared using 5 moles of Na^0 (s)? 4400155

a. 2
*b. 2.5
c. 3
d. 5

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF THE TERM MOLE BY PREDICTING EITHER THE MASS OF VOLUME OF A MOLE OF GIVEN OBJECTS. 100

Assuming a Federal budget of 200 billion dollars per year, how long could the country operate if we had one mole of dollars. Neglect inflation. 400230

a. 12×10^{34} years
b. $.33 \times 10^{-12}$ years
*c. 3×10^{12} years
d. 6×10^{23} years
e. none of the above

Suppose an atom were the size of a cube 1 cm on a side. If one mole of atoms were piled up in the form of a cube, what would be the approximate length of one edge of that cube? 4400231

a. 6.0×10^{23} cm = 3.6×10^{18} miles

b. 4×10^{20} cm = 2.4×10^{15} miles

c. $4 \times 10^{2.8}$ cm = .24 miles

*d. 4×10^{8} cm = 2400 miles

e. none of the above

THE STUDENT WILL APPLY HIS KNOWLEDGE OF MOLAR MASS BY SELECTING THE CORRECTLY CALCULATED MOLAR MASS FOR GIVEN COMPOUNDS. 101

The molar mass of H_2SO_4 is 4400232

a. 49 g.
b. 25 g.
c. 50 g.
d. 97 g.
*e. none of the above

The mass of one molecule of ethane, C_2H_6 is 4400233

a. 5 g.
*b. 5×10^{-23} g.
c. $.2 \times 10^{23}$ g.
d. 180×10^{23} g.
e. none of the above

GIVEN INFORMATION DESCRIBING THE COMPOSITION AND MOLAR MASS OF A COMPOUND, THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF MOLECULAR FORMULAS BY SELECTING THE CORRECT FORMULA FOR THE COMPOUND. 103

A gas consisting of 1.2 g. of carbon, .3 g. of hydrogen, and 1.6 g. of oxygen occupies nearly twice the volume as an equal volume of gaseous oxygen. The molecular formula of the gas is 4400236

a. CH_3O

*b. $C_2H_6O_2$

c. $C_3H_9O_3$

d. $C_2H_2O_2$

e. $C_3H_6O_3$

THE STUDENT IS ABLE TO DEMONSTRATE HIS ABILITY TO APPLY THE MOLE RATIO BY STATING THE EMPIRICAL FORMULA OF A COMPOUND. 254

A gas contains 1.4 grams of nitrogen for every 2.4 grams of oxygen. The empirical formula is 4400673

a. NO

b. N_2O

c. NO_2

*d. N_2O_3

e. N_2O_5

The mole ratio of hydrogen to carbon is 2. The empirical formula is 4400674

a. C_2H

b. C_2H_4

c. C_4H_2

*d. CH_2

e. CH

Source: Raytheon Chemistry, p. 35-36.

THE STUDENT WILL SHOW KNOWLEDGE OF THE ADVOGADRO NUMBER BY USING THE NUMBER TO DERIVE A SOLUTION OF A MOLE PROBLEM. 255

How many copper atoms are present in a piece of copper weighing 6.35g. 4400675

a. 6.0×10^{24}
b. 6.0×10^{23}
*c. 6.0×10^{22}
d. 3.0×10^{23}
e. 12.0×10^{23}

The number of total atoms in 0.25 mole of Na_3PO_4 is 4400676

a. $4 8 \times 10^{24}$
b. 3.6×10^{24}
c. 1.2×10^{23}
*d. 1.2×10^{24}
e. 4.8×10^{23}

If scientists had decided that there would be 10^{20} particles in a mole, the molar mass of nitrogen would be 4400677

*a. 4.6×10^{-3} g
b. 1.6×10^{5} g
c. 2.8×10^{-3} g
d. 1.4×10^{4} g
e. 5.6×10^{-2} g

Source: Raytheon Ehemistry, p. 32

THE STUDENT WILL APPLY THE CONCEPTS OF THE MOLE AND MOLAR MASS BY CALCULATING THE NUMBER OF MOLES OR PARTICLES FROM A GIVEN MASS. 257

The number of moles of oxygen atoms in 48 grams of oxygen gas is 4400680

a. 6.0
b. 1.5
*c. 3.0
d. 4.5
e. 2.0

A copper penny weighing 2.0 grams contains _____ atoms. 4400681

a. 2.0×10^{25}
b. 2.0×10^{23}
c. 1.8×10^{24}
d. 1.8×10^{21}
*e. 2.0×10^{22}

Source: Raytheon Chemistry, p. 34

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO APPLY THE MOLE CONCEPT BY CALCULATING THE AMOUNT OF A REACTANT OR PRODUCT GIVEN A REACTION AND THE AMOUNT OF ANY OTHER REACTANT OR PRODUCTS. 261

Based on the equation for the reaction: $2AgNo_3 + Cu \rightarrow Cu(No_3)_2 + 2Ag$. The amount of silver metal procuded by the reaction of 6.35 g of Cu will be 4400687

a. 10.8 g
b. 2.16 g
*c. 21.6 g
d. 108 g
e. 5.40 g

Methane when burned in air forms the combustion products carbon dioxide and water. The burning of 8.0 grams of methane will produce water in the amount of 4400688

a. 9.0 g
*b. 18 g
c. 27 g
d. 3.6 g
e. 2.7 g

Source: Raytheon Chemistry, pp. 48-49.

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF MOLE-VOLUME RELATIONSHIPS BY IDENTIFYING THE SOLUTION OF PROBLEMS BASED ON THE USE OF MOLAR VOLUME IN CHEMICAL REACTIONS. 269

Ethane gas burns in oxygen gas to produce carbon dioxide and water. If 3 moles of ethane are consumed, how many liters of oxygen will be required when reacting at STP. 4400700

a. 224 liters
b. 24.5 liters
c. 25.4 liters
*d. 235 liters
e. 257 liters

Zinc reacts with hydrochloric acid to produce hydrogen gas. To produce 33.6 liters of gas at STP will require which of the following amounts of Zinc. 4400701

a. 65.4 g
*b. 98.1 g
c. 44.8 g
d. 130.8 g
e. 67.2 g

Source: Raytheon Chemistry, pp. 65-66.

STRUCTURES, FORMULAS AND BONDING

GIVEN SUFFICIENT DATA, THE STUDENT WILL BE ABLE TO DETERMINE THE STRUCTURAL FORMULA OF SIMPLE ORGANIC COMPOUNDS. SPECIFICALLY, HE WILL BE ABLE TO 32

1. SELECT NEEDED INFORMATION.
2. CHOOSE ASSUMPTIONS IMPLICIT IN STRUCTURE DETERMINATION.
3. SELECT A SINGLE STRUCTURE CONSISTENT WITH THE AVAILABLE INFORMATION.

The following facts are determined about liquid X

1. The proton nuclear magnetic resonance spectrum contains two peaks in a 1:2 ratio.
2. X contains 38.7% carbon, 9.7% hydrogen, and 51.6% oxygen.
3. When burned completely, X forms CO_2 and H_2O.
4. X melts at $-17^\circ C$ and boils at $197^\circ C$.
5. The infrared absorption spectrum shows a frequency corresponding to the O-H stretching vibration.
6. The density of liquid X is 1.12g/ml
7. X vapor is 1.94 times as dense as oxygen gas measured at the same temperature and pressure.

Using these facts, the structural formula of X is to be determined.

Which of the following assumptions must be made about liquid X? 4400081

*a. It is a pure substance.
b. It contains no elements other than carbon, hydrogen, and oxygen.
c. Each molecule contains at least two oxygen atoms.
d. It is stable indefinitely.

In determining the structural formula for X, what is the logical sequence for using the available facts? 4400082

a. 4,6,3,2
b. 1,4,7,6
*c. 2,7,5,1
d. 7,4,3,5

Which of the following represents a STEP in determining the empirical formula of X. 4400083

*a. $\frac{38.7}{12}$; $\frac{9.7}{1.0}$; $\frac{51.6}{16}$
b. 1.94 x 38.7; 1.94 x 9.7; 1.94 x 51.6
c. $\frac{1}{2}$ x 1.12 x [197 - (-17)]
d. $\frac{1}{12}$; $\frac{1}{16}$; $\frac{12}{16}$

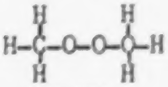
Which of the following expressions represents the molar mass of X? 4400084

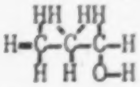
a. $\frac{38.7(12) + 9.7(1) + 51.6\ (16)}{12 + 1 + 16}$
*b. 1.94 x 32
c. 1.12 x [197 - (-17)]
d. 1.12 x 22.4

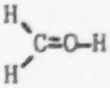
The empirical formula for X is found to be CH_3O and the molar mass 62.0. The molecular formula for X is 4400085

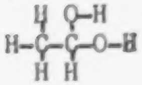
a. CH_3O
*b. $C_2H_6O_2$
c. $CH_2O_{3_0}$
d. C_3H_{10}

On the basis of the correct answer to question 5 and fact 5, the most likely structure for X is 4400086

a.

$H-\overset{H}{\underset{H}{C}}-O-O-\overset{H}{\underset{H}{C}}-H$

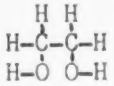
b.


c.


*d.

$H-\overset{H}{\underset{H}{C}}-\overset{O-H}{\underset{H}{C}}-O-H$

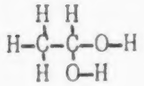
On the basis of all available information, what is the most likely structure for X. 4400087

*a.



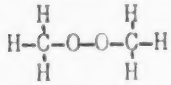
$\mathrm{H{-}\overset{H}{\underset{H{-}O}{C}}{-}\overset{H}{\underset{O{-}H}{C}}{-}H}$

b.



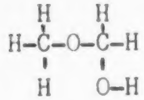
$\mathrm{H{-}\overset{H}{\underset{H}{C}}{-}\overset{H}{\underset{O{-}H}{C}}{-}O{-}H}$

c.



$\mathrm{H{-}\overset{H}{\underset{H}{C}}{-}O{-}O{-}\overset{H}{\underset{H}{C}}{-}H}$

d.



$\mathrm{H{-}\overset{H}{\underset{H}{C}}{-}O{-}\overset{H}{\underset{O{-}H}{C}}{-}H}$

Chemistry: Experiments and Principles, pages 312-327

THE STUDENT WILL BE ABLE TO CLASSIFY A SUBSTANCE AS MOLECULAR, METALLIC, IONIC, OR A NETWORK ON THE BASIS OF ITS EXPERIMENTAL PROPERTIES BY CHOOSING THE CORRECT FORM IN A GIVEN SITUATION. 44

Substance Z melts at 52°C and boils at 197°C. It is a poor conductor of electricity both in the solid and the liquid state. It is soft, non-lustrous, and only slightly soluble in water. Substance Z is a(an) 4400135

*a. molecular solid
b. metal
c. ionic solid
d. network solid

Substance W melts at 1250°C and boils at 1900°C. It is a poor electrical conductor in the solid state but conducts well when it is molten. Its crystals are brittle and water soluble. Substance W is a(an) 4400136

a. molecular solid
b. metal
*c. ionic solid
d. network solid

Chemistry: Experiments and Principles, pages 337-349.

GIVEN THE RELEVANT MOLECULAR WEIGHTS, THE STUDENT WILL APPLY AVOGADRO'S LAW AND SELECT THE SPECIFIC GRAM WEIGHT OF METHANE. 47

Two glass containers have the same volume. One is filled with methane gas and the other with carbon dioxide gas. Both containers are at the same temperature and pressure. One glass contains 44g. of carbon dioxide. How many grams of methane will the other glass contain? 4400141

a. 44 g.
*b. 16 g.
c. 32 g.
d. 64 g.

O'Conner et al Chemistry: Experiments and Principles, p. 36.

GIVEN THE CHEMICAL ANALYSIS "K", THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF COMPOUNDS BY SELECTING THE CORRECT EMPIRICAL FORMULA FOR A COMPOUND FROM A LIST. 52

Given 30 grams of a compound called ethane containing 24 grams of carbon and 6 grams of hydrogen. The empirical formula is 4400149

a. C_2H_6

*b. CH_3

c. C_3H_8

d. CH_2

O'Connor et al Chemistry: Experiments and Principles, p. 35.

GIVEN THE MOLECULAR WEIGHT AND THE EMPIRICAL FORMULA, THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF THE WRITING OF MOLECULAR FORMULAS BY SELECTING THE PROPER FORMULA FROM A LIST. 53

Given the molecular wt of butane as 58 and the empirical formula C_2H_5 the molecular formula is 4400150

a. C_2H_5

*b. C_4H_{10}

c. C_6H_{15}

d. C_8H_{20}

FROM THE RESULTS OF DIFFERENT EXPERIMENTS, THE STUDENT WILL APPLY HIS KNOWLEDGE OF CHARACTERISTICS OF COMPOUNDS AND ELEMENTS BY IDENTIFYING THE SUBSTANCE INVOLVED AS EITHER A COMPOUND OR ELEMENT. 98

In the following items read the description of what happens and answer (a) if the starting material is a compound, answer (b) if it is an element, and answer (c) if you cannot tell from the information given.

*c A white solid is heated gently producing a colorless gas and leaving no residue. 4400224

*a On heating a white solid, a colorless gas is formed leaving a black residue. 4400225

*b A metal is heated to 1000°C where it melts and then heated to 3000°C where it becomes a colorless gas. 4400226

*a A white solid was heated gently producing a gas which was partially condensed to a colorless liquid and a second white solid. 4400227

THE STUDENT WILL RECALL THE SIGNIFICANCE OF FORMULA WRITING AND MODEL EXPRESSION IN UNDERSTANDING MOLECULES BY CORRECTLY IDENTIFYING PERTINENT CHARACTERISTICS OF A PARTICULAR MODEL FROM A LIST. 99

Which of the following is NOT a valid use of a ball and spring model? 4400228

a. It shows the relative position of the atoms in the molecule.
b. It shows the number os atoms in the molecule.
c. It shows the relative distances between atoms in the molecule.
*d. It shows the probable shape of the molecule.
e. It shows the flexibility of chemical bonds.

The molecular formula for a compound gives information about all of the following except 4400229

*a. the arrangement of atoms.
b. the relative number of atoms.
c. the actual number of atoms.
d. the molecular weight.
e. the density of the gas state.

GIVEN THE CHEMICAL ANALYSIS OF A COMPOUND, THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF THE WRITING OF EMPIRICAL FORMULAS BY SELECTING THE CORRECTLY WRITTEN FORMULA. 102

For 7.6 grams of a gas containing only nitrogen and oxygen, analysis shows 2.8 grams to be nitrogen. The empirical formula for this compound is 4400234

*a. N_2O_3

b. N_2O_4

c. N_2O_5

d. N_2O

e. NO_2

A compound is analyzed and found to contain only 3.6 g. of carbon, .6 g. of hydrogen, and 4.8 of oxygen. The empirical formula must be 4400235

a. $C_2H_4O_2$

*b. CH_2O

c. CH_3O

d. CH_2O_2

e. CHO

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF THE PERIODICITY OF ELEMENTS BY SELECTING THE PROPERTIES FOR VARIOUS GIVEN ELEMENTS FROM A SERIES OF QUESTIONS. 140

Directions:

a. ⊗ ⊗ ⊗ ⊘
final s and p orbitals
(total electrons 9)

b. ⊗ ⊗ ⊗ ⊘
final s and p orbitals
(total electrons 35)

c. ⊗ ⊗ ⊗ ⊘
final s and p orbitals
(total electrons 17)

d. ⊗ ⊗ ⊗ ⊗
final s and p orbitals
(total electrons 10)

e. none of these

Which of the above has the highest boiling point? 4400370

*a

Which of the above has the lowest melting point? 4400371

*a

Which of the above has the lowest ioniz. energy? 4400372

*b

Which combines with sodium to form Na_2X?

*e

Source: Raytheon Chemstudy, p. 116

THE STUDENT WILL DISTINGUISH BETWEEN AN ELEMENT AND A COMPOUND BY IDENTIFYING THE PROPERTY THAT CHARACTERIZES A SUBSTANCE AS AN ELEMENT OR A COMPOUND. 252

Water is a compound. From the following list of characteristics identify the characteristic which does support water being a compound? 4400669

*a. water can be decomposed into hydrogen and oxygen gases.
b. water dissolves salt
c. water weighs 18g / mole
d. water boils at 100°C
e. wood burning forms water

Which of the following characteristics identifies hydrogen as an element? 4400670

a. hydrogen is a pure substance
b. hydrogen is a colorless gas
c. hydrogen burns to form water
*d. hydrogen cannot be decomposed
e. hydrogen is found as a diatomic molecule

Source: Raytheon Chemistry, p. 28-29.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF THE INFORMATION GIVEN IN A MOLECULAR FORMULA BY IDENTIFYING THE POINTS OF INFORMATION THAT ARE SHOWN IN A MOLECULAR FORMULA. 256

The molecular formula does not provide which of the following points of information? 4400678

a. kinds of atoms in molecule
b. number of atoms in molecule
*c. the structure of the molecule
d. atomic mass of the molecule
e. the symbol of each element

All of the following are molecular formulas except 4400679

a. H_2
*b. Xe
c. H_2O
d. S_8
e. CuO

Source: Raytheon Chemistry, p. 30-31.

THE STUDENT WILL DISTINGUISH BETWEEN HOMOGENEOUS AND HETEROGENEOUS MATERIALS BY PROPERLY IDENTIFYING EXAMPLES OF BOTH SYSTEMS. 274

All of the following materials are homogeneous except 4400709

a. gasoline
b. honey
c. diet cola
*d. milk
e. glass

All of the following materials are heterogeneous _except_ 4400710

*a. milk
b. concrete
c. copper sulfate solution
d. wood
e. chocolate covered cherry

Source: _Raytheon Chemistry_, p. 83

THE STUDENT WILL EXHIBIT HIS KNOWLEDGE OF METALS AND NON-METALS BY IDENTIFYING EXAMPLES OF EACH FROM A LIST. 284

Which of the following is _not_ a metal? 4400730

a. lead
b. iron
*c. carbon
d. magnesium
e. sodium

Which of the following is a non-metal? 4400731

a. calcium
b. copper
c. mercury
d. platinum
*e. sulfur

Source: _Raytheon Chemistry_, p. 102.

THE STUDENT WILL EXHIBIT UNDERSTANDING OF THE ORDER OF THE PERIODIC SYSTEM AS FOUND IN FAMILY RELATIONSHIPS AMONG ELEMENTS BY IDENTIFYING THE PROPER ELEMENT BASED ON THE DESCRIPTION OF FAMILY RELATIONSHIP. 285

The following properties are characteristic of an element member of a chemical family

I. reacts with water to release gas.
II. is a good conductor of electricity.
III. is a solid at room temperature.
IV. melts a few degrees above 25°C.
V. has a low ionization energy.

The element is: 4400732

a. lithium
b. iodine
c. calcium
*d. cesium
e. magnesium

The following properties are characteristic of an element member of a chemical family.

I. readily forms a gaseous hydride.
II. has the highest ionization energy of the family.
III. reacts readily with sodium to form ionic solid.
IV. gaseous hydride reacts with water to form acid.

The element is: 4400733

a. neon
b. chlorine
c. sulfur
d. oxygen
*e. fluorine

The following properties are characteristic of an element member of a chemical family.

I. forms compounds with oxygen and fluorine.
II. has a boiling temperature below 25°C.
III. does not form a known hydride.
IV. usually found in monotomic state.
V. has ionization energy of less than 300kcal/mole.

The element is: 4400734

a. helium
b. cesium
* c. xenon
d. rubidium
e. nitrogen

Source: Raytheon Chemistry, P. 103-118.

GIVEN THE PROPERTIES OF A COMPOUND, THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF BONDING BY SELECTING THE TYPE OF BONDING WHICH WILL MOST LIKELY OCCUR. 67

Given a compound which is soluble in water and has a high melting point. It is most likely to have which of the following type of bonding? 4400167

a. covalent
*b. ionic
c. metallic
d. van der waal

SOLUTIONS AND SOLUBILITY

THE STUDENT WILL BE ABLE TO ANALYZE BUFFERED SOLUTIONS. 37
SPECIFICALLY, HE WILL BE ABLE TO

1. ESTIMATE THE PH RANGE OVER WHICH THE BUFFER IS EFFECTIVE.
2. CALCULATE THE HYDROGEN ION CONCENTRATION OF BUFFERED SOLUTIONS BOTH BEFORE AND AFTER ADDING ACID OR BASE.
3. SELECT ASSUMPTIONS IMPLICIT IN THESE CALCULATIONS.

500 ml of solution is 0.5 molar with respect to both $NaHSO_4$ and Na_2SO_4.

4.0 grams of solid NaOH are added to the solution. Ka for HSO_4 is 1.3×10^{-2}

Which of the following equations represents the hydrogen ion concentration (x) before the NaOH is added? 4400111

*a. $\frac{0.5\,x}{0.5} = 1.3 \times 10^{-2}$

b. $\frac{x^2}{.5-x} = 1.3 \times 10^{-2}$

c. $x^2 = 1.3 \times 10^{-2}$

d. $10^{-7} + x = 1.3 \times 10^{-2}$

Which of the following assumptions is NOT implicit in the equation which correctly answers question 1? 4400112

a. The amount of hydrogen ion which comes from the ionization of water is insignificant compared to the amount which comes from the ionization of NSO_4^-

b. The amount of HSO_4 which ionizes is insignificant compared to the amount originally present.

c. H_2SO_4 is a strong acid.

*d. No hydroxide ion is present in solution.

To calculate final hydrogen ion concentration, which of the following assumptions would be most appropriate to make? 4400113

a. The concentration of hydrogen ion decreases by an amount equal to the concentration of the added sodium hydroxide.
*b. The concentration of HSO_4^- decreases by an amount equal to the concentration of the added sodium hydroxide.
c. The numerical value of Ka becomes $\frac{10^{-14}}{1.3 \times 10^{-2}}$
d. The product of hydrogen ion concentration and concentration of added sodium hydroxide is 10^{-14}

Which of the following equations represents the final hydroxide ion concentration (x)? 4400114

a. $.2x = 10^{-14}$
b. $\frac{x^2}{.5} = \frac{10^{-14}}{1.3 \times 10^{-2}}$
*c. $\frac{.7x}{.3} = 1.3 \times 10^{-2}$
d. $\frac{(x - 0.2)^2}{0.5} = 1.3 \times 10^{-2}$

Source: Chemistry: Experiments and Principles, pp. 240-242.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF SOLUTIONS BY IDENTIFYING STATEMENTS WHICH CORRECTLY STATE TYPES, TERMINOLOGY AND/OR DEFINITION. 276

Which of the following statements is NOT identifiable as proper in the discussion of solutions? 4400713

a. All gaseous mixtures are solutions.
b. Solid solutions are less common than gaseous solutions.
c. Metals form solid solutions called alloys.
d. Steel is iron containing dissolved carbon.
*e. The substance dissolved in water is the solvent.

Which of the following terms is NOT identifiable with solutions? 4400714

a. alloy
b. homogeneous
*c. heterogeneous
d. solute
e. universal solvent

Source: Raytheon Chemistry, p. 83-84.

THE STUDENT WILL EXHIBIT HIS UNDERSTANDING OF THE BEHAVIOR OF SOLUTIONS DURING PHASE CHANGES BY IDENTIFYING STATEMENTS WHICH SUPPORT SUCH BEHAVIOR. 277

Which of the following statements does NOT describe the behavior of a solution during a phase change? 4400715

a. The vapor pressure of a solution is less than that of the pure solvent.
b. The addition of solute raises the boiling point of the solution.
c. The higher the concentration of solute the higher the boiling point of the solution.
d. The addition of solute raises the freezing temperature of a solution.
*e. The boiling temperature remains constant as distillation of a solution progresses.

Desalination of sea water will become a necessity as populations expand rapidly. Which statement is NOT worthy of consideration in studying the problem. 4400716

*a. The density of seawater is the same as fresh water.
b. Salt water boils at a higher temperature than fresh water.
c. Salt water freezes at a lower temperature.
d. The boiling temperature raises as the liquid evaporates.
e. The melting temperature falls as the liquid freezes.

Source: Raytheon Chemistry, p. 84-85.

THE STUDENT WILL EXHIBIT HIS COMPREHENSION OF THE VARIATIONS AMONG PROPERTIES OF SOLUTIONS BY IDENTIFYING STATEMENTS WHICH SHOW THESE VARIATIONS IN PROPERTIES. 278

Which of the following statements is NOT a variation found in a property of solutions? 4400717

a. A rise in temperature increases solubility.
*b. The greater the solubility the better the solution conducts electricity.
c. Some solutions conduct electricity and some do not.
d. A solvent dissolving less than one gram of solute per liter is saturated.
e. All solids are soluble to a degree.

Which of the following has low solubility in water? 4400718

a. table salt.
b. sugar
*c. vegetable oil
d. molasses
e. vinegar

Source: Raytheon Chemistry, p. 87-88.

THE STUDENT WILL DEMONSTRATE HIS COMPREHENSION OF THE MOLAR CONCENTRATION OF SOLUTIONS BY CALCULATING THE MOLARITY, MASS OF SOLUTE, OR VOLUME OF SOLUTION GIVEN THE OTHER TWO. 279

The mass of Cu $SO_4 - 5H_2O$ needed to prepare 3ℓ 0.5 M solution is 4400719

a. 208 g
*b. 374 g
c. 166 g
d. 332 g
e. 416 g

Using 120 grams of solid Na OH you can prepare _____ liters of 0.05 M solution. 4400720

a. 45
b. 72
c. 30
d. 24
*e. 60

The molarity of 5 l of $AgNO_3$ solution containing 340 grams of $AgNO_3$ is 4400721

a. .01 M
b. 0.1 M
c. .04 M
*d. 0.4 M
e. none of these

Source: Raytheon Chemistry, p. 87-88.

THE STUDENT WILL APPLY SOLUBILITY PRINCIPLES BY CORRECTLY IDENTIFYING A SUBSTANCE FROM ITS SOLUBILITY CHARACTERISTICS WITH OTHER KNOWN SUBSTANCES. 51

Given substance x which is soluble in sodium hydroxide, but is not soluble in sodium sulfate. The substance is 4400148

*a. Sr^{2+}
b. K^+
c. NH_4^+
d. Mg^{2+}

O'Connor et al Chemistry: Experiments and Principles, p. 97.

GIVEN THE SOLUBILITY PRODUCT OF A SUBSTANCE (Ksp), THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF SOLUBILITY IN MOLES/L. BY SELECTING THE CORRECTLY CALCULATED MOLAR/L. EXPRESSION FROM A LIST. 70

Given Ksp of $SrCrO_4$ as 3.6×10^{-5}. The solubility of $SrCrO_4$ in moles/l. is: 4400170

*a. 6×10^{-3} moles/l.
b. 6×10^{-2} moles/l.
c. 3.6×10^{-5} moles/l.
d. 3.6×10^{-6} moles/l.

O'Conner et al. Chemistry: Experiments and Principles, p. 244.

GIVEN THE SOLUBILITY CONSTANT OF A SUBSTANCE OR THE SOLUBILITY, THE STUDENT WILL APPLY HIS KNOWLEDGE OF SOLUBILITY BY SELECTING THE CORRECT CONSTANT OR SOLUBILITY OF AN EQUATION. 88

The K_{sp} for $A_g I_{(s)} \rightleftarrows A_{g(aq)}^{+} + I_{(aq)}^{-}$ is 4×10^{-16}, what is the solubility of $A_g I_{(s)}$? 4400209

*a. 2×10^{-8} moles/l.
b. 2×10^{-16} moles/l.
c. 4×10^{-16} moles/l.
d. 4×10^{-8} moles/l.
e. 1×10^{-4} moles/l.

The K_{sp} for $PbCl_{2(s)} \rightleftarrows Pb^{+2}_{(aq)} + 2Cl^{-}_{(aq)}$ is 32×10^{-6}. 4400210

a. 32×10^{-3} moles/l.
*b. 2×10^{-2} moles/l.
c. 8×10^{-3} moles/l.
d. 32×10^{-2} moles/l.
e. 32×10^{-6} moles/l.

The solubility of $A_2B_{3(\ )}$ is 1×10^{-2} , the solubility constant is 4400211

a. 1×10^{-2}
b. 1×10^{-4}
c. 1×10^{-6}
*d. 1×10^{-8}
e. 1×10^{-10}

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF SOLUBILITY PRODUCT BY PREDICTING THE POINT AT WHICH A PRECIPITATE WILL FORM IN GIVEN SITUATIONS. 90

If you have a fifty milliliter solution of 2.0×10^{-5}M $AgNO_3$, a precipitate will form when fifty milliliters of which of the following is added? K_{sp} of $A_g Cl_{(s)} = 1.8 \times 10^{-10}$ 4400214

a. Tap water (Cl^{-} concentration = 2×10^{-5})
*b. 2.0×10^{-5}M calcium chloride
c. 2.0×10^{-5}M sodium chloride
d. 2.0×10^{-5}M hydrogen chloride
e. none of the above

Being a creative artist as well as a chemistry student, you would like to make your own paint particularly a bright yellow color. Realizing that lead chloride, Pb Cl_2, is yellow, how many grams of $Pb(NO_3)_2$ would you need to add to 500 ml of a 1 x 10^{-3}M solution or N_aCl to be sure to get a precipitate of lead chloride. K_{sp} Pb $Cl_2 = 2 \times 10^{-8}$ 4400215

a. 4 x 10^{-2} g.
b. 6.64 x 10^{-6} g.
c. 3.32 x 10^{-6} g.
*d. 1.33 x 10^{-1} g.
e. 1.33 x 10^{-5} g.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF THE TABLE OF SOLUBILITY OF IONIC COMPOUNDS IN WATER BY SELECTING ION PAIRS WHICH ARE SOLUBLE IN WATER. 283

Which of the following compounds exhibits low solubility in water? 4400728

*a. $CaSO_4$
b. $Ca(OH)_2$
c. $Ca(C_2H_3O_2)_2$
d. CaS
e. CaI_2

Which of the following compounds is highly soluble in water? 4400729

a. LiCl
b. NH_4Cl
c. $BaCl_2$
*d. CuCl
e. $MgCl_2$

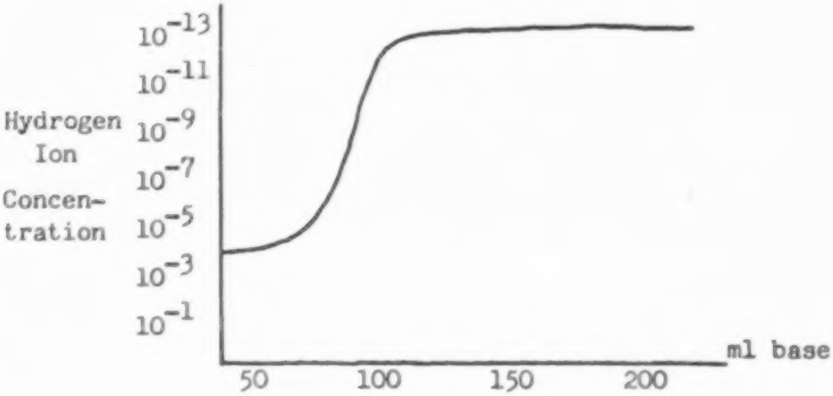
Source: Raytheon Chemistry, p. 97.

ACIDS AND BASES

THE STUDENT WILL BE ABLE TO INTERPRET TITRATION CURVES FOR ACID-BASE REACTIONS BY 43

1. SELECTING THE RELATIVE STRENGTH OF THE ACID AND BASE.
2. LOCATING THE EQUIVALENCE POINT.
3. SELECTING AN INDICATOR SUITABLE FOR DETERMINING THE EQUIVALENCE POINT.

A student slowly adds a 0.1 M solution of base B to 100 ml of a 0.1 M solution of acid A. Hydrogen ion concentration is continuously measured during the titration. The data obtained is recorded on a graph:



From the shape of the graph, what can be concluded about the strength of A and B? 4400132

a. A and B are both strong
b. A is strong while B is weak
*c. A is weak while B is strong
d. A and B are both weak

The hydrogen ion concentration at the equivalence point is approximately 4400133

a. 10^{-3} M
b. 10^{-7} M
*c. 10^{-10} M
d. 10^{-13} M

Which indicator would be best for determining the equivalence point of this titration? 4400134

a. methyl red
b. methyl orange
c. litmus
*d. phenol phthalein

Chemistry: Experiments and Principles, pages 262-264.

THE STUDENT WILL APPLY THE BRONSTED-LOWRY THEORY BY SELECTING THOSE EQUATIONS IN WHICH WATER ACTS AS A BRONSTED ACID OR BASE. 62

In the following reactions in which case is water acting as a Bronsted acid?

a. $Si\ (OH)_4 + H_2O \longrightarrow$
b. $O_2S\ (OH)_2 + H_2O \longrightarrow$
*c. $NH_3 + H_2O \longrightarrow$
d. $O_3Cl(O4) + H_2O \longrightarrow$

In the following reactions in which case is water acting as a Bronsted base. 4400162

*a. $NOH + HCl \longrightarrow$
b. $NA^o + NOH \longrightarrow$
c. $NH_3 + HOH \longrightarrow$
d. $C_2H_3O_2^- + HOH \longrightarrow$

O"Conner et al Chemistry: Experiments and Principles, Chap. 14.

THE STUDENT SHOULD BE ABLE TO DETERMINE THE NUMBER OF GRAMS OF A BASE OR OF AN ACID FROM THE RESULTS OF DATA COLLECTED FROM A TITRATION EXPERIMENT BY SELECTING THE CORRECTLY CALCULATED GRAM AMOUNT. 68

Given: 10.0 ml of a 0.010 M. HCl solution used to titrate 20.0 ml of sodium hydroxide. The number of grams of sodium hydroxide present is 4400168

a. .0001 g
b. .005 g
*c. .004 g
d. .00365 g

GIVEN THE KA VALUE AND CONCENTRATION OF A WEAK ACID, THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF CALCULATING HYDROGEN ION CONCENTRATION BY SELECTING THE CORRECTLY CALCULATED ION CONCENTRATION. 69

If you dissolve 0.01 mole of hydrogen carbonate in enough water to make 2 liters of solution the hydrogen ion concentration will be (use table 14-4 for KA of H_2CO_3) 4400169

a. 9.4×10^{-6}
*b. 9.4×10^{-3}
c. $.88 \times 10^{-4}$
d. $.88 \times 10^{-2}$

O"Connor et al Chemistry: Experiments and Principles, Chap. 14.

EQUATIONS AND EQUILIBRIUM

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF BALANCED CHEMICAL EQUATIONS BY SELECTING A PROPERLY BALANCED EQUATION OF A GIVEN WORD EQUATION. 59

When octane (C_8H_{18}) burns, the products are carbon dioxide and water. The correct chemical equation is 4400156

a. $C_8H_{18(g)} + 9O_{2(g)} \longrightarrow 8CO_{2(g)} + 9H_2O_{(g)}$

b. $C_8H_{18(g)} + 4.5O_{2(g)} \longrightarrow 8CO_{2(g)} + 9H_2O_{(g)}$

c. $C_8H_{18(g)} + 9O_{(g)} \longrightarrow 8CO_{2(g)} + 9H_2O_{(g)}$

*d. $C_8H_{18(g)} + 12.5O_{2(g)} \longrightarrow 8CO_{2(g)} + 9H_2O_{(g)}$

THE STUDENT WILL EXHIBIT HIS COMPREHENSION OF WRITING PROPERLY BALANCED EQUATIONS BY SELECTING THE CORRECT EQUATION FOR STATED REACTANTS AND PRODUCTS. 259

Silver reacts with nitric acid to form nitrogen dioxide, silver nitrate and water. The correct equation is 4400684

a. $Ag + A_2(NO_3)_2 \longrightarrow NO_2 + AgNO_3 + H_2O$
b. $2Ag + 4HNO_3 \longrightarrow 2NO_2 + 2AgNO_3 + 2H_2O$
c. $2Ag + 3\,HNO_3 \longrightarrow NO_2 + 2AgNO_3 + H_3O$
*d. $Ag + 2HNO_3 \longrightarrow NO_2 + AgNO_3 + H_2O$
e. $Ag + 4HNO_3 \longrightarrow NO_2 + Ag(NO_3)_2 + 2H_2O$

Potassium nitrate decomposes giving oxygen gas and potassium chloride. The correct equation is 4400685

*a. $KClO_3 \longrightarrow KCl + 1\frac{1}{2}O_2$
b. $KClO_3 \longrightarrow KCl + 2O_2$
c. $2KClO_3 \longrightarrow 2KCl + 2O_3$
d. $KClO_3 \longrightarrow KCl + O_3$
e. $KCl(O_3)_2 \longrightarrow KCl + 3O_2$

Source: Raytheon Chemistry, pp. 45-47

THE STUDENT WILL BE ABLE TO DIFFERENTIATE SYSTEMS AT EQUILIBRIUM OR IN A STEADY STATE BY STATING WHETHER OR NOT THE SYSTEM FITS INTO THESE CATEGORIES. 34

Consider each of the following systems. Circle

a. if the system is at equilibrium
b. if the system is in a steady state
c. if the system does not fall into either of the above classes

An even, non-flickering bunsen burner flame. 4400100

a.
*b.
c.

A solution of sodium chloride in contact with excess solid. The amount of solid neither increases nor decreases. 4400101

*a.
b.
c.

A flock of geese whose population remains constant from year to year. 4400102

a.
*b.
c.

A slowly rusting steel bridge. 4400103

a.
b.
*c.

A sealed tube containing a mixture of NO_2 and N_2O_4 kept at constant temperature. The color of the tube's contents does not change. 4400104

*a.
b.
c.

Chemistry: Experiments and Principles, pages 228-229.

THE STUDENT WILL BE ABLE TO PREDICT THE EFFECT OF A TEMPERATURE CHANGE UPON THE FORWARD AND REVERSE REACTION OF A SYSTEM AT EQUILIBRIUM BY SELECTING THE CORRECT RESULT OF AN INCREASE IN TEMPERATURE ON THESE RATES. 35

How would an increase in temperature affect the forward and reverse rates of this reaction? 4400105

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + 22\text{k cal}$$

a. The forward rate increases; the reverse rate stays constant.
b. The reverse rate increases; the forward rate stays constant.
c. Both rates increase, but the forward rate increases to a greater extent.
*d. Both rates increase, but the reverse rate increases to a greater extent.

Chemistry: Experiments and Principles, page 234

THE STUDENT WILL BE ABLE TO PREDICT THE EFFECT OF CHANGES IN CONCENTRATION, PRESSURE, TEMPERATURE, AND CATALYST UPON AMOUNTS OF REACTANT AND PRODUCT PRESENT AT EQUILIBRIUM BY SELECTING WHETHER EQUILIBRIUM AMOUNTS INCREASE OR DECREASE IN GIVEN SITUATIONS. 36

Consider the reaction:

$$2SO_2(g) + O_2(g) \rightleftarrows 2SO_3(g) + \text{heat}$$

What effect would the following changes have on the equilibrium amounts. Circle

a. If the amounts of SO_2 and SO_3 increase while the amount of O_2 decreases.

b. If the amounts of SO_2 and O_2 increase while the amount of SO_3 decreases.

c. If the amounts of SO_2 and O_2 decrease while the amount of SO_3 increases.

d. If the amounts of all three substances rise.

e. If the amounts of all three substances stay the same.

Temperature is raised. 4400106

a.
*b.
c.
d.
e.

Additional SO_2 is added. 4400107

*a.
b.
c.
d.
e.

Volume is decreased. 4400108

a.
b.
*c.
d.
e.

A catalyst is added. 4400109

a.
b.
c.
d.
*e.

Additional SO_3 is added. 4400110

a.
b.
c.
*d.
e.

Chemistry: Experiments and Principles, pages 233-236.

GIVEN AN ENERGY BOLSTERED EQUATION, THE STUDENT WILL ANALYZE A REACTION AT EQUILIBRIUM BY SELECTING THE CORRECTLY CALCULATED OUTCOME OF THE REACTION FROM THE ENERGY BOOST. 64

$$\text{Given: } 2NH_{3(g)} + 22\text{ Kcal} \rightleftarrows N_{2(g)} + 3H_{2(g)}$$

Which of the following best describes what happens when energy is added to the system. 4400164

a. amount of NH_3 would increase.
b. amount of N_2 would decrease.
*c. amount of N_2 and H_2 would increase
d. amount of H_2 would increase.

THE STUDENT WILL BE ABLE TO RECOGNIZE THE EFFECT OF A CATALYST ON AN EQUILIBRIUM SYSTEM BY SELECTING THE EFFECT WHICH BEST EXPLAINS A GIVEN REACTION. 80

Adding a catalyst to the following system may have some effect on the equilibrium of the system.

$$\overset{\text{(clear}}{Fe^{+3}} + \overset{\text{(clear)}}{SCN^{-}} \rightleftarrows \overset{\text{(deep red)}}{Fe\ SCN^{+2}}$$

From the statements below, select the one with the proper cause and effect relationship. 4400196

a. The color will deepen because the catalyst effects only the rate of the forward reaction.
b. The color will lighten because the catalyst effects only the rate of the reverse reaction.
c. The color will not change because the catalyst effects neither forward or reverse reaction.
*d. The color will not change because the catalyst increases the rate of both forward and reverse reactions.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF THE BASIC PROPERTIES OF AN EQUILIBRIUM SYSTEM BY CORRECTLY IDENTIFYING THOSE INDIVIDUAL CHARACTERISTICS WITHIN SAMPLE SITUATIONS. 81

Two boys are balanced on a see-saw. This is NOT a case of equilibrium in the chemical sense because 4400197

*a. it is not dynamic.
b. it is not a closed system.
c. there are no constant properties.
d. it is not a steady state system.
e. it is not an open system.

A stoppered flask is half filled with water. This is an equilibrium system for all of the following reasons except 4400198

a. the amount of liquid water is constant.
b. the flask is stoppered.
c. the amount of gaseous water is constant.
d. the rate of evaporation equals the rate of condensation.
*e. none of the above.

THE STUDENT WILL BE ABLE TO IDENTIFY EQUILIBRIUM SYSTEMS AS OPPOSED TO STEADY STATE SYSTEMS BY SELECTING THE EXAMPLE OF AN EQUILIBRIUM SYSTEM FROM A LIST OF ALTERNATIVE SYSTEMS. 82

Which of the following is an equilibrium system rather than a steady state system. 4400199

a. The number of cars on a given mile of highway is constant.
b. The number of people in line to buy tickets is constant.
c. The number of homework assignments you have each night is constant.
d. The number of dogs in the dog pound is constant.
*e. The number of textbooks you take home each day is constant.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF EQUILIBRIUM SYSTEMS BY SELECTING FROM A SET OF EQUATIONS THE ONE EXHIBITING EQUILIBRIUM FOR A GIVEN SITUATION. 83

In an open glass of iced tea, there are some ice cubes and some undissolved sugar on the bottom. The glass is in an open room. Which of the following is at equilibrium? 4400200

a. $H_2O_{(l)} \rightleftarrows H_2O_{(g)}$
b. $H_2O_{(l)} \rightleftarrows H_2O_{(s)}$
*c. $\text{Sugar}_{(s)} \rightleftarrows \text{Sugar}_{(aq)}$
d. $H_2O_{(s)} \rightleftarrows H_2O_{(g)}$
e. $\text{Sugar}_{(s)} \rightleftarrows \text{Sugar}_{(g)}$

THE STUDENT WILL BE ABLE TO APPLY THE LAW OF CHEMICAL EQUILIBRIUM BY PREDICTING THE VALUE OF THE EQUILIBRIUM CONSTANT FROM GIVEN DATA. 84

During a 1,000 mile marathon swim, 1/3 of the participants must be in the pool, 1/3 waiting to swim and 1/3 resting. Assuming the product of this activity is to be in the pool, select the equilibrium constant for swimmers and non-swimmers from the following numbers. 4400201

a. 1
b. $\frac{1}{2}$
c. 2
d. 1/3
*e. 3

THE STUDENT WILL BE ABLE TO ANALYZE AN EQUILIBRIUM EXPERIMENT BY SELECTING WHICH ASSUMPTIONS ARE NECESSARY TO THE EXPERIMENT. 85

An experimenter introduces 1 mole of hydrogen and 1 mole of iodine gas into a flask. At a later time, he analyzes the contents for hydrogen and finds that there is only $\frac{1}{2}$ of a mole present. He then calculates the equilibrium constant as 4.00 by using the equation

$$H_{2\,(g)} + I_{2(g)} \rightleftarrows 2\ HI_{(g)}$$

Which of the following is NOT an assumption implicit to this calculation? 4400202

a. Equilibrium has been established.

b. One half mole of I_2 will react with $\frac{1}{2}$ mole of H_2.

c. No hydrogen gas has diffused out of the flask.

d. Some hydrogen does not react with I_2 to form H_2I_2.

*e. Initially, the rate of the forward reaction exceeds that of the reverse reaction.

THE STUDENT WILL BE ABLE TO APPLY THE LAW OF CHEMICAL EQUILIBRIUM TO CHEMICAL SYSTEMS BY SELECTING THE CORRECTLY CALCULATED CONSTANT VALUE FROM OTHER PERTINENT DATA. 92

In the reaction between Hydrogen and Iodine to form hydrogen iodine, $H_2 + I_2 \rightleftharpoons 2\ HI$, it can be determined that $[H_2] = 2.0$; $[I_2] = 3.0$; and $[HI] = 4.0$. What is the value of the equilibrium constant? 4400217

a. $\frac{4}{6}$
b. $\frac{6}{4}$
*c. $\frac{8}{3}$
d. $\frac{3}{8}$
e. $\frac{4}{3}$

In the reaction, $2A + B_2 \rightleftharpoons 2\ AB$, we start with 1.0×10^{-2} M of A and 1.0×10^{-2} M of B and no AB. At equilibrium, there appears to be $.5 \times 10^{-2}$ mole/L of AB. What is the value of the equilibrium constant? 4400218

a. 2/3
b. 3/2
*c. 133
d. .75
e. 3×10^{-2}

THE STUDENT APPLIES THE PRINCIPLES OF EQUILIBRIUM TO UNFAMILIAR EQUILIBRIUM EQUATIONS BY IDENTIFYING THE CHANGE OF A SPECIFIC CONCENTRATION WITHIN THE EQUATION. 138

Directions: If $A_{2(g)} + 2B_{(g)} \rightleftharpoons 2\ A\ B_{(g)}$ and H is -, what will happen to the equilibrium concentration of A_2? It ____________

a. "increases in amount"
b. "decreases in amount"
c. "shows no change"

The volume of the closed system is increased. 4400357

*a. increases
b. decreases
c. no change

The temperature of the closed system is decreased 10° C (volume staying the same). 4400358

*a. increases
b. decreases
c. no change

A catalyst is added. 4400359

a. increases
b. decreases
*c. no change

AB forms a precipitate. 4400360

a. increases.
*b. decreases
c. no change

[B] is decreased. 4400361

*a. increases
b. decreases
c. no change

1 mole of noble gas "C"$_{(g)}$ is introduced into the closed reaction chamber. 4400362

a. increases
*b. decreases
c. no change

The temperature of the system is reduced to -270° C. 4400363

a. increases
*b. decreases
c. no change

Source: Raytheon Chemstudy, p. 232

Which of the following will not reach a state of equilibrium? 4400364

a. The stopcock between two flasks of different gases is opened for several hours.
*b. $AgCl_{(s)}$ is placed in a closed beaker.
c. $H_2O_{(s)}$ in a closed beaker at room temperature is permitted to sit for half an hour.
d. Moth flakes are placed in a sealed plastic bag.
e. Crystals of I_2 are placed in a test tube of distilled water and a stopper is inserted.

Which of the following will attain equilibrium? 4400365

a. a burning candle in a silver candlestick holder.
b. a boiling teakettle whistling on the burner of the stove for 5 minutes.
*c. 1 tbsp. sugar dissolved in 8 oz. lemon juice in a closed plastic container.
d. a terrarium that is not covered.
e. none of these.

Source: Raytheon Chemstudy, Chap. 13

THE STUDENT DEMONSTRATES HIS UNDERSTANDING OF THE CALCULATIONS INVOLVED IN FINDING EQUILIBRIUM CONSTANT "K" BY IDENTIFYING THE VALUE OF THE CONSTANT IN AN EQUATION. 139

When $A^+ + B^- \rightleftharpoons AB$, K eq is 4400366

a. $\frac{[A^+] + [B^-]}{[AB]}$

b. $\frac{[AB]^2}{[A^+]\,[B^-]}$

*c. $\frac{[AB]}{[A^+]\,[B^-]}$

d. $\frac{[AB]}{[A^+] + [B^-]}$

e. $\frac{[A^+]\,[B^-]}{[AB]}$

When $A^{2+} + 2B^- \rightleftharpoons AB_2$ K eq is 4400367

a. $\frac{[A^{2+}] + 2[B^-]}{[AB_2]}$

*b. $\frac{[AB_2]}{[A^{2+}] + [B^-]^2}$

c. $\frac{[AB_2]}{[A^{2+}] + [B^-]^2}$

d. $\frac{[A^{2+}]\,[B^-]^2}{[AB]^2}$

e. $\frac{[A^{2+}] + [2B^-]}{[AB_2]}$

When $2A^{3+} + 3B^{2-} \rightleftarrows A_2B_{3(s)}$ then K eq = 4400368

*a. $\dfrac{1}{[A^{3+}]^2\ [B^{2-}]^3}$

b. $\dfrac{[A_2B_2}{[2A^{3+}] + [3B^{2-}]}$

c. $\dfrac{[A^{2+}]^2\ [3B^{2-}]}{[A_2B_3}$

d. $\dfrac{[A^{3+}]^2[B^{2-}]^3}{[A_2B_3]}$

e. $\dfrac{[A^{3+}]^2\ [B^{2-}]^3}{1}$

When 1L. of 2 $\frac{M}{L}$ AOH is added to 1L of 4 $\frac{M}{L}$ HB, AB and H_2O are formed. What is Keq for this reaction? 4400369

*a. 1
b. 2
c. 1.25×10^{-1}
d. 2.5×10^{-1}
e. none of these

Source: Raytheon Chemistry p. 240.

OXIDATION-REDUCTION

THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF THE PRINCIPLE OF OXIDATION-REDUCTION EQUATIONS BY 42

1. IDENTIFYING THE OXIDIZING AGENT AND THE REDUCING AGENT.
2. DETERMINING NUMBER OF ELECTRONS TRANSFERRED PER FORMULA UNIT OF OXIDIZING AGENT AND REDUCING AGENT.
3. ADJUSTING THE COEFFICIENTS SO THAT NET ELECTRON GAIN AND ELECTRON LOSS ARE EQUAL.
4. INTRODUCING APPROPRIATE SPECIES INTO THE EQUATION TO ACHIEVE CHARGE AND MASS BALANCE.
5. BALANCING THE COMPLETED EQUATION.

When solutions of K Mn O_4, H_2O_2, and KOH are mixed, the following reaction occurs:

$$MnO_4^- + H_2O_2 + \ldots\ldots \rightarrow MnO_2 + \ldots\ldots$$

The reducing agent is 4400128

a. MnO_4^-
*b. H_2O_2
c. MnO_2
d. O_2

The number of electrons gained per formula unit of MnO_4^- is 4400129

a. 1
*b. 3
c. 5
d. 7

In order to balance this equation, which of the following changes should be made? 4400130

a. Add H^+ to the left and $H_2O$to the righ t.
b. Add OH to the left and H_2O to the right.
c. Add H_2O to the left and OH to the right.
*d. Add both OH and H_2O to the right.

Reading from left to right, the coefficients of the complete, balanced equation are 4400131

*a. 2, 3, 2, 3, 2, 2
b. 2, 3, 2, 2, 3, 2
c. 2, 3, 2, 2, 3, 4
d. 2, 3, 4, 2, 3, 2

<ins>Chemistry: Experiments and Principles</ins>, pages 305-307.

THE STUDENT WILL APPLY THE HALF REACTION METHOD TO BALANCE AN OXIDATION-REDUCTION EQUATION BY SELECTING A CORRECTLY BALANCED REACTION FROM A LIST. 63

Given:

$Mn^{2+} + 4H_2O \longrightarrow 5e^- + MnO_4^- + 8\ H^+ \qquad E^o = -1.52V.$

$2Ag^o + S^{-2} \longrightarrow Ag_2S + 2e \qquad E^o = +\ 0.69\ V.$

The balanced equation for silver being oxidized is 4400163

a. $2Mn^{2+} + 5\ Ag_2S + 8\ H_2O \longrightarrow 10\ Ag^o + 5\ S^{-2} + 2\ MnO_4^- + 16H^+$
*b. $2MnO_4^- + 10\ Ag^o + 5\ S^{-2} + 16H^+ \longrightarrow 5Ag_2S + 2Mn^{+2} + 8H_2O$
c. $2Mn^{+2} + 10Ag^o + 8H_2O + 5S^{-2} \longrightarrow 5\ Ag_2S + 2MnO_4^- + 16H^+$
d. $5Ag_2S + 2MnO_4^- + 16H^+ \longrightarrow 2Mn^{+2} + 10Ag + 8H_2O + 5S^{-2}$

<ins>Chemistry: Experiments & Principles,</ins> Chp. 15.

THE STUDENT WILL APPLY HIS UNDERSTANDING OF THE OXIDATION NUMBER METHOD IN BALANCING OXIDATION-REDUCTION EQUATIONS BY SELECTING THE CORRECTLY BALANCED REACTION FROM A LIST. 65

Zinc reacts with nitric acid to give zinc nitrate, nitrogen dioxide and water. The balanced equation is 4400165

a. $Zn + 2HNO_3 \longrightarrow Zn(NO_3)_2 + NO_2\ H_2O$

b. $Zn + 2HNO_3 \longrightarrow Zn\ NO_3 + NO_2 + H_2O$

*c. $Zn + 4HNO_3 \longrightarrow Zn(NO_3)_2 + 2NO_2 + 2H_2O$

d. $Zn + HNO_3 \longrightarrow Zn\ NO_3 + NO_2 + H_2O$

THE STUDENT SHALL ANALYZE A REDOX REACTION BY PREDICTING COMPONENTS OF ANOTHER REACTION. 150

Which of the following is NOT true?

In an $Al^o - Al^{3+}$ and $Pb^o - Pb^{2+}$ cell there will be 4400427

*a. no visible reaction
b. decreasing mass of aluminum
c. precipitation of Pb^o
d. an aluminum anode
e. electric current produced

In a $Ca^o - Ca^{2+}$ and $Al^o - Al^{3+}$ cell, which of the following is (are) true? 4400428

1. No visible reaction occurs.
2. Al^o decreases in mass.
3. Calcium precipitates.
4. Aluminum acts as the anode.
5. Electric current is produced.

a. 1 and 2
b. 2 and 3
c. 1
*d. 5
e. none of the above

Source: Raytheon Chemistudy, p. 293.

GIVEN A HYPOTHETICAL SITUATION, THE STUDENT WILL APPLY HIS UNDERSTANDING OF REDOX REACTIONS BY PREDICTING REACTIVITY TO VARIOUS ELEMENTS. 151

Working as a laboratory assistant you must store solutions in containers. If you have available to you the following containers

1. lead 2. zinc 3. silver 4. aluminum 5. copper

In which of the above would you store lead nitrate solution? 4400429

a. 1, 2 or 3
*b. 3 or 5
c. 2 or 3
d. 2 or 4
e. all of the above

In which of the above would you store $Pb(NO_3)_{2(S)}$? 4400430

a. 1, 2, or 3
b. 3 or 5
c. 2 or 3
d. 2 or 4
*e. all of the above

In which of the above would you NOT store cobalt chloride solution? 4400431

a. 1, 2 or 3
b. 3 or 5
c. 2 or 3
*d. 2 or 4
e. all of the above

In which would you store sulfuric acid? 4400432

a. 1, 2 or 3
*b. 3 or 5
c. 2 or 3
d. 2 or 4
e. all of the above

In which of the above would you store a potassium bromide solution? 4400433

a. 1, 2 or 3
b. 3 or 5
c. 2 or 3
d. 2 or 4
*e. all of the above

In which would you store magnesium ribbon? 4400434

a. 2, 1 or 3
b. 3 or 5
c. 2 or 3
d. 2 or 4
*e. all of the above

Source: Raytheon Chemstudy, Chapter 15.

REACTIONS AND RATES

THE STUDENT WILL BE ABLE TO APPLY THE CONCEPT OF RATE DETERMINING STEP TO ASSEMBLY LINE PROCESSES BY SELECTING THE RATE DETERMINING PERSON AND THE TURN OUT RATE IN A GIVEN SITUATION. 24

Four persons work on the assembly line of a plant which bottles distilled water.

Person	Job	Maximum Rate
W	Fills bottles	250 bottles/hour
X	Puts on caps	400 bottles/hour
Y	Puts on labels	300 bottles/hour
Z	Packs bottles	150 bottles/hour

Which person has the job which would be considered rate determining? 4400056

a. W
b. X
c. Y
*d. Z

At what rate would bottles of distilled water be turned out by this assembly line? 4400057

*a. 150 bottles/hour
b. 400 bottles/hour
c. 1100 bottles/hour
d. $\frac{1100}{4}$ bottles/hour

Chemistry: Experiments and Principles, pp. 209-210.

THE STUDENT CAN DEMONSTRATE A KNOWLEDGE OF REACTION MECHANISMS BY 25

1. DETERMINING THE NET REACTION.
2. IDENTIFYING THE CATALYST.
3. SELECTING THE STEP WHICH IS RATE DETERMINING AND SELECT A REASONABLE EXPLANATION FOR THE PREDICTION.

The mechanism often suggested for the reaction between hydrogen iodide and hydrogen peroxide is

(1) $H^+ + I^- + H_2O_2 \longrightarrow HOI + H_2O$
(2) $I^- + HOI \longrightarrow I_2 + OH^-$
(3) $H^+ + OH^- \longrightarrow H_2O$

To determine the net equation for this reaction, one would 4400058

*a. take the algebraic sum of the steps in the mechanism
b. find the rate determining step of the mechanism
c. omit the catalyst from each step in the mechanism
d. identify the species which appear in two or more steps

Which species serves as catalyst in this mechanism? 4400059

a. H^+
b. OH^-
c. H_2O_2
*d. No catalyst is involved in this mechanism

Which step is most likely to be rate determining? 4400060

*a. The first, since it involves a three particle collision.
b. The first, since it involves both ionic and molecular reactants.
c. The third, since concentration of hydroxide ion must be low in acid solution.
d. The third, since water has a great tendency to ionize.

Chemistry: Experiments and Principles, pp. 218-222.

THE STUDENT WILL BE ABLE TO INTERPRET MACROSCOPIC PROCESSES IN TERMS OF FACTORS WHICH DETERMINE RATES OF CHEMICAL REACTIONS BY SELECTING THE APPROPRIATE ANALOGOUS SITUATION. 26

Highway accident rates can be interpreted in terms of factors similar to those which influence rates of chemical reactions. Each of the statements below indicates a change in one such factor.

Circle

A if the factor is analogous to reactant concentration
B if the factor is analogous to temperature
C if the factor is analogous to catalyst
D if the factor is unrelated to a factor which affects the rate of chemical reactions

Circle

W if the change is expected to increase accident rate
X if the change is expected to have no effect on accident rate
Y if the change is expected to decrease accident rate
Z if the change is expected to affect accident rate in an unpredictable fashion

Average distance between cars decreases from 100 feet to 40 feet

*A B C D 4400061

*W X Y Z 4400062

Average speed decreases from 50 to 30 miles per hour

A *B C D 4400063

W X *Y Z 4400064

Each driver consumes four ounces of rum before entering the highway.

A B *C D 4400065

*W X Y Z 4400066

The percent abundance of trucks on the highway increases from 10% to 20%.

A B C *D 4400067

W X Y *Z

THE STUDENT WILL BE ABLE TO RATIONALIZE THE EXTREME TEMPERATURE DEPENDENCE OF REACTION RATES ON THE BASIS OF TWO CONCEPTS - 27

1. RATE IS DETERMINED BY THE FRACTION OF COLLISIONS BETWEEN REACTANT MOLECULES WHICH PROVIDE THE ACTIVATION ENERGY
2. A SMALL INCREASE IN TEMPERATURE CAN LEAD TO A LARGE INCREASE IN THIS FRACTION

BY CHOOSING THE BEST EXPLANATION FOR AN INCREASE OF RATE IN A PARTICULAR CHEMICAL REACTION.

Which of the following statements best explains why the rate of a particular chemical reaction triples as temperature is raised from 5^{o} C to 15^{o} C? 4400069

a. Average molecular speed triples.
b. Pressure of the reactants triples.
*c. The number of collisions which supplies the activation energy triples.
d. The activation energy decreases by a factor of three.

Chemistry: Experiments and Principles, pages 212-214.

GIVEN THE NECESSARY DATA INVOLVED IN A PARTICULAR REACTION, THE STUDENT WILL APPLY HIS KNOWLEDGE OF HEAT OF REACTION BY, 1) SELECTING A BALANCED EQUATION FOR THE REACTIONS, 2) SELECTING THE CORRECTLY CALCULATED HEAT OF REACTIONS AND, 3) DETERMINING THE EXTENT OF THE REACTION. 50

Given: Nitrogen dioxide$_{(g)}$ reacts with hydrogen$_{(g)}$ to form
water$_{(g)}$ and ammonia$_{(g)}$

ΔH for ammonia$_{(g)}$ = -11 Kcal/mole

ΔH for nitrogen dioxide$_{(g)}$ = +8.1 Kcal/mole

ΔH for water$_{(g)}$ = -57.8 Kcal/mole

The balanced equation is 4400145

a. $NO_{2(g)} + 7H_{(g)} \rightarrow NH_{3(g)} + 2H_2O_{(g)}$

b. $2NO_{(g)} + 5H_{2(g)} \rightarrow 2NH_{3(g)} + 2H_2O_{(g)}$

*c. $2NO_{2(g)} + 7H_{2(g)} \rightarrow 2NH_{3(g)} + 4H_2O_{(g)}$

d. $NO_{2(g)} + 7H_{2(g)} \rightarrow NH_{3(g)} + 2H_2O_{(g)}$

The heat of reaction is 4400146

a. +85.0 Kcal
*b. -297.4 Kcal
c. +59.9 Kcal
d. +265.0 Kcal

Would you predict the reaction to take place 4400147

*a. Yes
b. No

O'Conner et al Chemistry: Experiments and Principles, p. 198.

THE STUDENT CAN DEMONSTRATE KNOWLEDGE OF REACTION RATES BY IDENTIFYING WHICH HAVE THE FASTEST RATE OF REACTION FROM A LIST OF REACTIONS. 61

Which of the following reactions will have the fastest reaction rate under normal conditions? 4400160

a. $CH_4 + O_2 \longrightarrow$
b. $Cl_2 + O_2 \longrightarrow$
*c. $H^o + O^o \longrightarrow$
d. $H_2 + O_2 \longrightarrow$

O'Conner, et al Chemistry: Experiments and Principles, Chap. 12.

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF THE USE OF THE PERIODIC TABLE TO FIND MOLECULAR WEIGHT BY PREDICTING CHEMICAL REACTIONS. 134

If 1 g. of sodium reacts with water, what phenomenon is observed? 4400338

a. nothing
b. Precipitate is formed
c. solution changes to white
*d. bubbles are formed
e. a smelly gas is formed

Source: Raytheon Chemistry: Experiments and Principles, p. 114

How many g. of the product observed above are formed? 4400339

*a. 4.4×10^{-2}
b. 9×10^{-2}
c. 1×10^{-1}
d. 1
e. 2

THE STUDENT WILL APPLY HIS UNDERSTANDING OF THE LAW OF COMBINING PROPORTIONS BY SELECTING THE CORRECT OUTCOMES IN GIVEN REACTIONS. 143

If 2.24 L of oxygen at STP combine with 0.1 mole M then the compound formed will have the formula 00379

a. M_2O

b. MO

c. M_2O_3

*d. MO_2

e. none of these

If 8 g of oxygen and 6.2 g of phosphorous combine, then the empirical formula of this phosphorous oxide must be 4400380

a. PO

b. P_2O

c. P_2O_3

d. PO_2

*e. P_2O_5

If the empirical formula is discovered to be AB_2 and the molar mass is 42, and A is observed to be of molar mass 12, and B of molar mass 1, what is the formula of the substance? 4400381

a. AB

b. AB_2

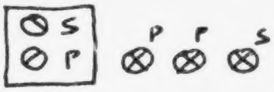
c. A_2B_2

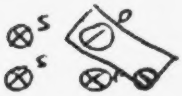
*d. A_3B_6

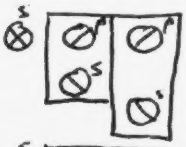
e. AB_3

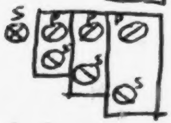
Source: Raytheon Chemstudy, p. 35.

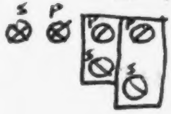
If an element in column I of the periodic table combines with an element in column VII, the electron orbital configuration of the final s & p orbitals will be: 4400382

*a. 

b. 

c. 

d. 

e. 

Source: Raytheon Chemstudy, p. 177.

THE STUDENT SHOULD BE ABLE TO DISTINGUISH BETWEEN EXOTHERMIC AND ENDOTHERMIC REACTIONS BY IDENTIFYING REACTIONS AS ONE OR THE OTHER. 260

Identify the reaction which is not an exothermic reaction from the list below. 4400686

a. oxidation of wood
*b. decomposition of water
c. burning of methane
d. combustion of gasoline
e. none of these

Source: Raytheon Chemistry, p. 43

THE STUDENT WILL EXHIBIT AN UNDERSTANDING OF DISSOCIATION OF IONIC COMPOUNDS AND THEIR RESULTANT MOLAR CONCENTRATIONS BY SHOWING SOLUTIONS TO PROBLEMS INVOLVING REACTIONS OF IONIC COMPOUNDS OF KNOWN CONCENTRATION IN SOLUTION. 282

When 2.00 l of 0.500 m $BaCl_2$ solution is mixed with 1.00 l of 0.400 m K_2CrO_4 solution a precipitate forms. Determine the final concentration of all the ionic species and identify the correct answer below. 4400126

a. Concentration K^+ = 0.267m

b. Concentration Cl^- = 0.667m

*c. Concentration CrO_4^{2-} = 0.133m

d. Concentration Ba^{2+} = 0.200m

e. None of these

When 100 ml of 2.00 m $AgNO_3$ solution is mixed with an equal amount of 0.500m NaCl solution a precipitate forms. Determine the final concentration of all ionic species present and identify the the correct answer below. 4400127

a. Concentration Ag^+ = 0.100m

b. Concentration NO_3^- = 0.200m

c. Concentration Na^+ = 0.0500m

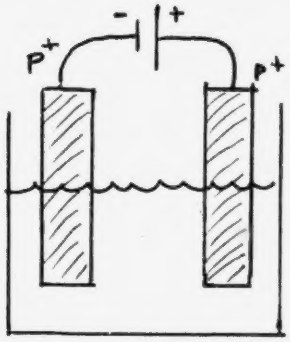
d. Concentration Cl^- = neglible

*e. None of these

Source: Text: Raytheon Chemistry, p. 93

ELECTROLYSIS

THE STUDENT WILL RECALL THE PROCESS OF ELECTROLYSIS IN AQUEOUS SOLUTIONS BY SELECTING CHANGES WHICH OCCUR DURING THE ELECTROLOYSIS OF AQUEOUS SOLUTIONS. 40



Items 1 and 2 refer to the diagram shown at the left.

1 M NaCl in H_2O

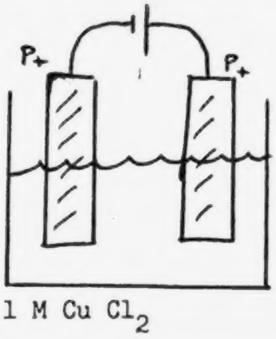
The substances which form at the cathode and anode are, respectively, 4400123

a. sodium and chlorine
*b. hydrogen and chlorine
c. hydrogen and oxygen
d. sodium and oxygen

After current has flowed for several days, how should the electrolyte by labelled? 4400124

a. 1 M NaCl
*b. 1 M NaOH
c. 1 M HCl
d. pure water

GIVEN EQUATIONS FOR THE HALF REACTIONS OCCURRING IN AN ELECTROLYSIS CELL AND CURRENT TIME DATA, THE STUDENT WILL APPLY HIS KNOWLEDGE OF THE RELATIONSHIP BETWEEN CURRENT AND CHARGE BY CALCULATING THE AMOUNTS OF PRODUCT FORMED DURING THE CELL REACTION. 41



Cell half-reactions:

$Cu^{+2} + 2e^- \longrightarrow Cu$

$2Cl^- \longrightarrow Cl_2 + 2e^-$

Items refer to the diagram shown above. A current of 10 amps flows through the cell for one hour.

How many coulombs of electric charge flow through the cell? 4400125

- *a. 10x60x60
- b. 10x60
- c. $\frac{60x60}{10}$
- d. $\frac{60}{10}$

If the correct answer to question 1 is represented by "q", the number of moles of electrons flowing through the cell is represented by 4400126

- a. $q \times 6.02 \times 10^{23}$
- b. $q \div (6.02 \times 10^{23})$
- c. $q \times 96,500$
- *d. $q \div 96,500$

If the correct answer to question 2 is represented by "f", which of the following represents moles of chlorine formed during the cell reaction? 4400127

- *a. $\frac{f}{2}$
- b. f
- c. f^2
- d. 2f

Chemistry: Experiments and Principles, pages 299-301.

THE STUDENT WILL APPLY HIS UNDERSTANDING OF THE CALCULATIONS INVOLVED IN ELECTROLYSIS BY SELECTING THE CORRECT NUMBER OF GRAMS OF A METAL PRODUCED IN A GIVEN ELECTROLYTIC SITUATION. 66

How many grams of tin can be produced by a constant current of 5.0 amps. flowing through a cell containing $SnCl_4$ solution for 15 hours? 4400166

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE CLASSES OF ELECTROLYTES AND THEIR PROPERTIES BY IDENTIFYING COMPOUNDS WHICH EXHIBIT THESE PROPERTIES AS ELECTROLYTES. 280

A solution tastes sour, litmus indicator becomes red and hydrogen gas is liberated when zinc metal is added to solution. The following oompound dissolved in water is: 4400722

a. NaCl
*b. H_3PO_4
c. KOH
d. $AgNO_3$
e. KBr

A solution conducts electricity, turns litmus dye blue and is slippery when felt. The water solution contains the compound, 4400723

a. NaCl
b. H_3PO_4
*c. KOH
d. $AgNO_3$
e. KBr

Source: Raytheon Chemistry, p. 95-96.

THE STUDENT WILL RECALL THE ELECTRIC PROPERTIES OF CONDENSED PHASES BY INDICATING THOSE STATEMENTS WHICH DEFINE ELECTRIC PROPERTIES. 281

All of the following statements are true definitions except: 4400724

a. the movement of an electric charge is called an electric current.
b. ions with a positive charge are called cations.
*c. cations will migrate to the cathodes in a conducting solution.
d. ions with a negative charge are called anions.
e. ions in a water solution are identified as such by term "aqueous."

All the following are correct representations except: 4400725

a. Ag^+ is a cation
b. Cl^- is an anion
c. (aq) denotes in water
d. $NaCl_{(S)} \rightarrow Na^+(aq) + Cl^-(aq)$
*e. $CaCl_{2(S)} \rightarrow Ca^{2+}(aq) + Cl^{2-}(aq)$

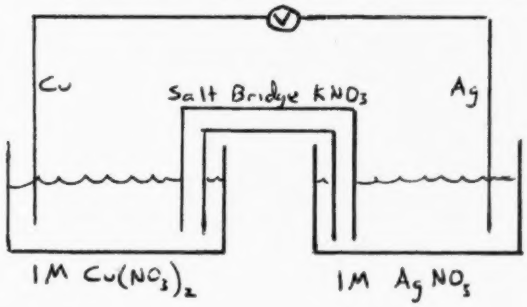
Source: Raytheon Chemistry, p. 92-93

ELECTROCHEMICAL CELL

GIVEN A DIAGRAM FOR AN ELECTROCHEMICAL CELL, THE STANDARD HALF REACTIONS OCCURRING IN THE CELL, AND THEIR RESPECTIVE STANDARD OXIDATION POTENTIALS, THE STUDENT WILL BE ABLE TO RECALL TERMS AND PROCESSES OF THE CELL BY IDENTIFYING THE FOLLOWING. 38

A. THE CATHODE AND THE ANODE
B. THE OXIDIZING AGENT AND THE REDUCING AGENT
C. THE DIRECTION OF ION FLOW IN SOLUTION
D. THE DIRECTION OF ELECTRON FLOW THROUGH THE EXTERNAL CIRCUIT
E. THE OVERALL CELL REACTION
F. THE STANDARD POTENTIAL OF THE CELL
G. THE EFFECT OF CONCENTRATION CHANGES ON CELL VOLTAGE

Questions are based on the electrochemical cell shown below:



$Cu \longrightarrow Cu^{+2} + 20^{-} \; E^{o} = -.34V$

$Ag \longrightarrow Ag^{+} + 0^{-} \; E^{o} = -.80V$

The cathode is 4400115

a. the copper electrode
*b. the silver electrode
c. the copper ion in solution
d. the silver ion in solution

The oxidizing agent is 4400116

a. the copper electrode
b. the silver electrode
c. the copper ion in solution
*d. the silver ion in solution

After the cell runs for several hours, which of the following changes would be observed? 4400117

*a. many copper ions would be found in the silver half cell.
b. Many silver ions would be found in copper half cell.
c. Most of the nitrate ions would be trapped in the salt bridge.
d. Most of the silver and copper ions would be trapped in the salt bridge.

Electrons flow 4400118

*a. from the copper electrode to the silver electrode through the external circuit.
b. from the copper electrode to the silver electrode through the salt bridge.
c. from the silver electrode to the copper electrode through the external circuit.
d. from the silver electrode to the copper electrode through the salt bridge.

The equation for the net chemical reaction occurring in this cell is 4400119

a. $Cu + Ag \rightarrow Cu^{+2} + Ag^{+}$
b. $Cu^{+2} + Ag^{+} \rightarrow Cu + Ag$
*c. $Cu + 2Ag^{+} \rightarrow Cu^{+2} + 2Ag$
d. $Cu^{+2} + 2Ag \rightarrow Cu + 2Ag$

The standard potential of this cell (measured in volts) is 4400120

*a. $-.34 - (-.80)$
b. $-.80 - (-.34)$
c. $-.34 - .80$
d. $.34 + .80$

Which of the following changes would cause the potential of this cell to rise above the standard potential? 4400121

*a. Replace the 1 M $Cu(NO_3)_2$ solution with 0.1 M $Cu\ (NO_3)_2$

b. Replace the 1 M $AgNO_3$ solution with 0.1 M $AgNO_3$

c. Use larger electrodes

d. Increase the concentration of KNO_3 in the salt bridge.

Chemistry: Experiments and Principles, pp. 280-286.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF OXIDATION POTENTIAL AS A MEASURE OF THE RELATIVE TENDENCY OF A REDUCED SPECIES TO DONATE ELECTRONS BY SELECTING THE STATEMENT WHICH BEST EXPLAINS THE RELATIONSHIP BETWEEN THE OXIDATION POTENTIALS OF ZINC AND COPPER. 39

$Zn \rightarrow Zn^{+2} + 2e$ $E^o = .76V$

$Cu \rightarrow Cu^{+2} + 2e$ $E^o = -.34V$

Which of the following statements best explains the relationship between the oxidation potentials of zinc and copper? 4400122

a. Zinc has a positive tendency to be oxidized while copper has a negative tendency.
*b. Zinc metal will donate electrons to Cu^{+2} ions in solution.
c. The voltage of an electrochemical cell involving zinc will be positive while that of copper will be negative.
d. Zinc ions are more stable than copper ions.

Chemistry: Experiments and Principles, pages 285-286.

QUALITATIVE ANALYSIS

THE STUDENT WILL IDENTIFY UNKNOWN SOLUTIONS BY ANALYZING CHEMICAL REACTIONS AND SELECTING THE UNKNOWN FROM THE PRECIPITATE FORMED. 142

Directions: You have four colorless solutions, unlabeled as to content and of unknown order but labeled 1, 2, 3, 4. They are: AB, CD, EF, and GB.

Reactions of these are

$AB \rightleftharpoons A^+ + B^+$

$CD \rightleftharpoons C^+ + D^-$

$EF \rightleftharpoons E^+ + F^-$

$GB \rightleftharpoons G^+ + B^-$

$A^+ + D^- \rightleftharpoons AD_{(s)}$ red

$E^+ + B^- \rightleftharpoons EB_{(s)}$ yellow

Use the data in this chart to identify the unknowns. (Reactions observed in laboratory when different solutions were mixed.)

	1	2	3	4
1				
2	no ppt			
3	no ppt.	yellow ppt		
4	red ppt	yellow ppt	no ppt	

Which of the following is unknown #1? 4400375

a. AB
*b. CD
c. EF
d. none of these

Which of the following is unknown #2? 4400376

a. AB
b. CD
c. GB
*d. none of these

Which of the following is unknown #3? 4400377

a. CD
b. EF
*c. GB
d. none of these

Which of the following is unknown #4? 4400378

*a. AB
b. CD
c. EF
d. None of these

GIVEN PARTIAL INFORMATION ABOUT THE PROCEDURE FOR A QUANTITATIVE ANALYSIS AND APPROPRIATE DATA, THE STUDENT WILL BE ABLE TO 33

1. SELECT ASSUMPTIONS IMPLICIT IN THE PROCEDURE.
2. SELECT NEEDED EQUIPMENT.
3. LIST SOURCES OF ERROR AND PREDICT THE EFFECT OF EACH ERROR.
4. SELECT AN APPROPRIATE FLOW CHART FOR THE CALCULATIONS.
5. SELECT A NUMERICAL SET-UP WHICH LEADS TO THE FINAL RESULT.
6. EXPRESS THE FINAL RESULT TO THE PROPER NUMBER OF SIGNIFICANT FIGURES.

The weight percent of iodate ion in a solid unknown (T) is determined by the following procedure:

1.487 grams of T is dissolved in 100 ml of 2.0 M H_2SO_4. 3.0 grams of solid KI is added to the solution, causing the reaction

$$IO_3^- + 5I^- + 6H^+ \longrightarrow 3I_2 + 3H_2O$$

to occur. The resulting solution is titrated with 0.1024 M $Na_2S_2O_3$ to a starch end point. 42.74 ml of the titrant are used.

Which of the following assumptions must be made about T? 4400088

a. It is completely water soluble.
b. It contains no basic components.
*c. It contains no oxidizing agent other than iodate.
d. It contains no iodide ion.

In the reaction $IO_3^- + 5I^- + 6H^+ \longrightarrow 3I_2 + 3H_2O$ what must be completely used up? 4400089

*a. IO_3^-
b. I^-
c. H^+
d. the starch indicator

Which container would be best for this analysis? 4400090

a. 250 ml beaker
*b. 250 ml Erlenmeyer flask
c. 500 ml beaker
d. 500 ml Erlenmeyer flask

A series of errors might be made in the procedure. Predict the probable effect of each error if made, on the final result (percentage of iodate). Circle

a. if the final result will be high.
b. if the final result will be unaffected.
c. if the final result will be low.
d. if the final result will be incorrect, but in an unpredictable direction.

90Ml of 2 M H_2SO_4 is used. 4400091

a.
*b.
c.
d.

The burette is not rinsed with titrant before filling. 4400092

*a.
b.
c.
d.

The rest point of the balance shifts while weighing T. 4400093

a.
b.
c.
*d.

3.7 grams of KI are used 4400094

a.
*b.
c.
d.

The molarity of the titrant (recorded as .1024) is actually .1029 4400095

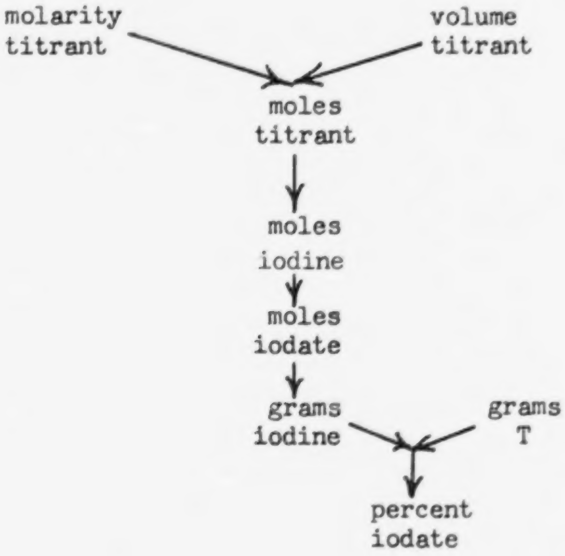
a.
b.
*c.
d.

The initial weight of T (recorded as 1.487 grams) is actually 1.503 grams. 4400096

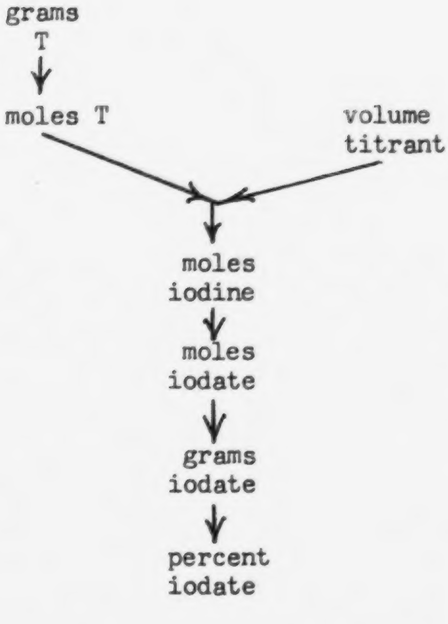
*a.
b.
c.
d.

Which sequence of steps would be the most logical way to determine the final result? 4400097

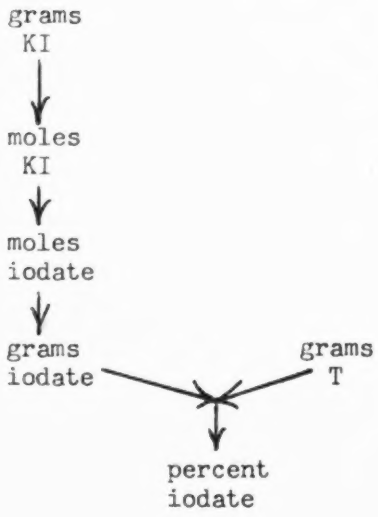
*a.


molarity titrant
volume titrant
moles titrant
moles iodine
moles iodate
grams iodine
grams T
percent iodate

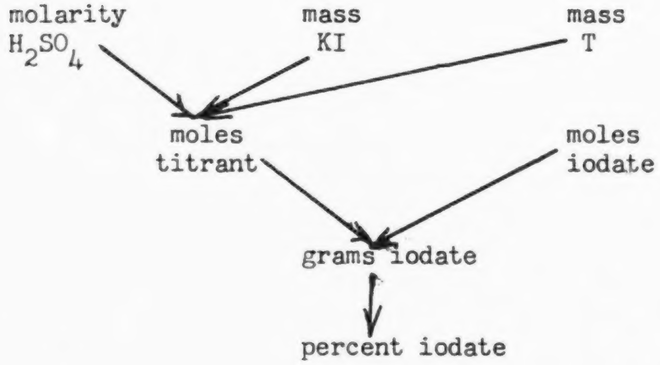
b.


grams T
moles T
volume titrant
moles iodine
moles iodate
grams iodate
percent iodate

c.


grams
KI
moles
KI
moles
iodate
grams
iodate
grams
T
percent
iodate

d.


molarity
H_2SO_4
mass
KI
mass
T
moles
titrant
moles
iodate
grams iodate
percent iodate

Which of the following expressions represents the final result 4400098

a. $\left(\frac{.100 \times 1.487}{3 \times 2 \times .1024 \times .04274}\right) \times 100\%$

*b. $\left(\frac{.1024 \times .04274 \times \frac{1}{2} \times \frac{1}{3} \times 175.0}{1.487}\right) \times 100\%$

c. $\left(\frac{\frac{3.0}{166} \times \frac{1}{5} \times 175}{1.487}\right) \times 100\%$

d. $\left(\frac{175 \times 3.0 \times 2.0 \times \frac{1}{5}}{166 \times 1.487 \times .1024 \times 98}\right) \times 100\%$

How many significant figures should be in the final result? 4400099

a. 1
b. 2
c. 3
*d. 4

THE STUDENT WILL ANALYZE THE RESULTS OF COMBINING AN UNKNOWN SOLUTION WITH A KNOWN SOLUTION BY CORRECTLY SELECTING THE IONS FORMED IN THE UNKNOWN SOLUTION. 144

Directions: You have a colorless solution containing 3 unknown cations and NO_3^- ions. Use these data concerning formation of precipitate with solutions added.

	$NaCl$	Na_2SO_4	Na_2S	$NaOH$	$NH_4C_2H_3O_2$
Unknown	+	+	+	+	—

What 3 cations might be present? 4400383

a. Na^+, Cu^+, Mg^{2+}
b. Ag^+, Pb^+, Hg_2^{2+}
c. Ba^{2+}, Ag^+, Cu^+
*d. Pb^{2+}, Ba^{2+}, Ag^+
e. Ca^{2+}, Pb^{2+}, Sr^{2+}

Directions: You have a colorless solution containing 3 unknown anions and Na^+ ions.

What 3 anions might be present? Which answer is incorrect? 4400384

*a. PO_4^{3-}, NO_3, CO_3^{2-}

b. Cl^- , Br^-, I^-

c. Cl^- , SO_4^{2-}, S^{2-}

d. SO_3^{2-}, CO_3^{2-}, I^-

e. SO_4^{2-}, S^{2-}, OH^-

Source: Raytheon Chemstudy, p. 97.

LIFE SCIENCES

CAPILLARITY

THE STUDENT IS ABLE TO APPLY THE PRINCIPLE OF CAPILLARITY LEARNED IN A CONTROLLED SITUATION, TO EXPLAIN A SIMILAR ONE BY SELECTING FROM A LIST THE ONE THAT CORRECTLY DESCRIBES THE CAUSE OF CAPILLARY. 115

One month after studying the phenomenon of capillarity in school, you develop acute appendicitis. At the hospital a medical technologist sticks your finger with a lancet to obtain a drop of blood. He then places the end of a glass capillary tube in the drop of blood. You are amazed to see the blood flow up the tube and try to figure out why.

A number of explanations are possible. Select from the explanations given below the one that best explains why the blood flowed up the tube. 4400276

a. The slight difference in air pressure between the top and bottom of the tube pushed the blood up the tube.
b. The force of adhesion drew the blood up the tube.
c. The force of cohesion drew the blood up the tube.
*d. Both forces - cohesion and adhesion - drew the blood up the tube.

Source: Modern Biology, Moon, Mann, and Towele, 1960.

DIFFUSION AND OSMOSIS

THE STUDENT WILL BE ABLE TO APPLY THE PRINCIPLES OF DIFFUSION AND OSMOSIS BY PREDICTING AND SELECTING FROM A LIST WHAT PHYSICAL OR CHEMICAL CHANGE, IF ANY, WILL OCCUR WHEN A PIECE OF VEGETABLE SUCH AS CARROT, POTATO OR BEET IS PLACED IN A SALT SOLUTION. 116

You have acquired some knowledge of the principles of diffusion of gases and liquids and of the process of osmosis. From this knowledge you are to predict what changes, if any, will occur when a section of potato is placed in a salt solution of .08%. Assume that the concentration of salt in the potato cell is .05%. Select the statement you believe describes what the results will be from the four options below: 4400277

a. Water becomes less and less salty as the potato absorbs the salt.
b. Vegetable cells are impermeable to salt ions, therefore, nothing happens.
*c. Water moves from an area of high concentration to an area of low concentration the cells will become placid.
d. Water moves from an area of low concentration to an area of high concentration the cells become turgid.

Source: Modern Biology, Moon, Mann, and Towele, 1960.

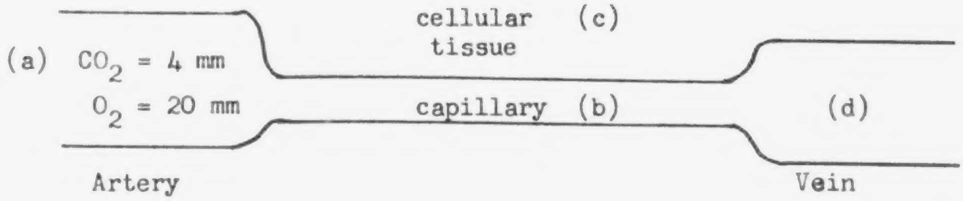
THE STUDENT WILL APPLY THE CONCEPT OF GAS DIFFUSION THROUGH A SEMI-PERMEABLE MEMBRANE BY SELECTING WHAT CHANGES IN GASEOUS TENSION WOULD OCCUR AS A RESULT OF DIFFUSION. 125

Problem: Given blood absorbs O_2 and loses CO_2 in the lungs, whereas, at the cellular level the reverse process takes place.

By applying the principles of gaseous diffusion, predict the changes that would occur in each of the situations below by selecting the option you think is applicable.

Drawing A shows the pressure of O_2 and CO_2 in an artery before it enters a capillary and finally a vein.

Drawing A


cellular tissue (c)
(a) CO_2 = 4 mm
O_2 = 20 mm
capillary (b)
(d)
Artery
Vein

In drawing A the tissue pressure (c) of O_2 is 4400295

a. than 20 mm
*b. than 20 mm
c. = to 20 mm
d. = to zero

The tissue pressure (c) of CO_2 is 4400296

*a. than 4 mm
b. than 4 mm
c. = to 4 mm
d. = to zero

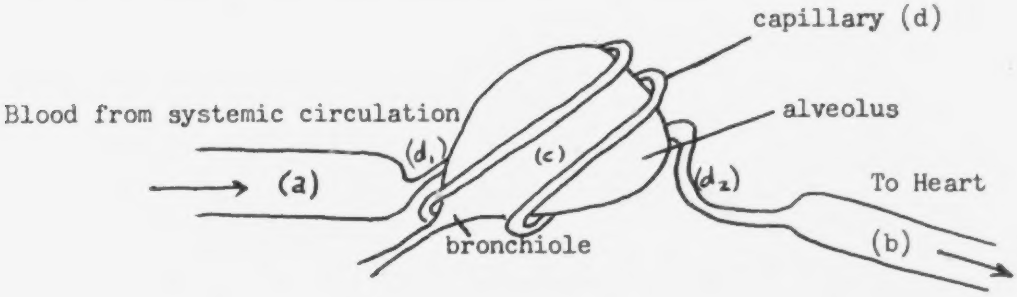
In the vein (d) the pressure of O_2 is 4400297

a. than 20 mm
b. = to 20 mm
*c. = to tissue pressure (c)
d. = to zero

In the vein (d), the pressure of CO_2 is 4400298

a. than 4 mm
b. = to 4 mm
c. than tissue pressure (c)
*d. than 4 mm

Drawing B shows the arrangement of artery, capillary, and alveolus in the lung. Analyze the drawing in light of the statement below and select the option that correctly describes the situation.


capillary (d)
Blood from systemic circulation
alveolus
(d_1)
(c)
(a)
(d_2)
To Heart
bronchiole
(b)

In the alveolus (c) at the end of inspiration the pressure of O_2 is 4400299

a. than in (d)
*b. than in (d)
c. than in (a)
d. than in (b)

In the vein (b) at the end of inspiration the pressure of CO_2 is 4400300

a. than in (c)
*b. than in (c)
c. than in (d_2)
d. than in (d_1)

The pressure of O_2 in (b) at the end of expiration is 4400301

a. than in (a)
b. than (d_2)
c. than in (c)
*d. than (d_1)

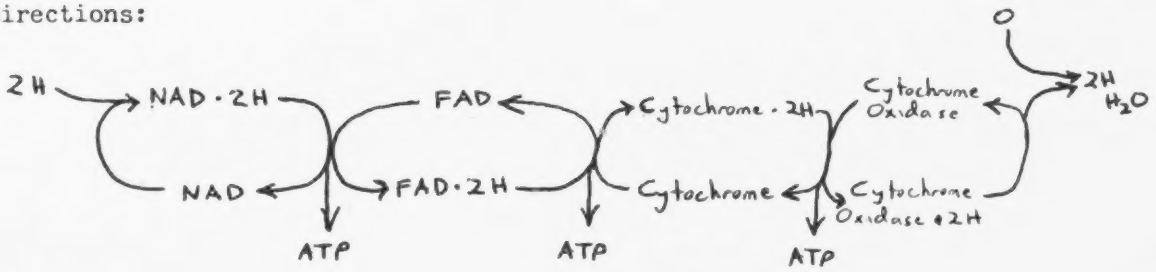
The pressure of CO_2 in (b) at the end of expiration is 4400302

a. than in (a)
b. = (c)
c. = to (a)
*d. than (c)

ELECTRON TRANSPORT SYSTEM

THE STUDENT CAN RECALL THE ELECTRON TRANSPORT SYSTEM AND WILL ABLE TO IDENTIFY A DIAGRAM OF IT. 169

Directions:



2H
NAD·2H
NAD
FAD
FAD·2H
Cytochrome·2H
Cytochrome
Cytochrome Oxidase
Cytochrome Oxidase +2H
O
2H
H_2O
ATP
ATP
ATP

The reaction referred to above is called 4400493

- *a. the electron transport system
- b. Kreb cycle
- c. Calvin cycle
- d. citric acid cycle
- e. the flavin system

THE STUDENT CAN ANALYZE THE RELATIONSHIPS IN THE ELECTRON TRANSPORT SYSTEM AND DETERMINE THE INTERRELATIONSHIPS BETWEEN ITS PARTS USING THE GIVEN WORD EQUATION. 170

Directions: REFER TO THE ABOVE DIAGRAM.

The source of hydrogen in NAD 2H is 4400494

- a. the electron transport system
- b. the cytochrome system
- *c. the Kreb cycle
- d. the flavin system
- e. the Calvin cycle

Which of the following materials has the highest chemical bond energy? 4400495

a. water
*b. NAD 2H
c. FAD 2H
d. cytochrome 2H
e. cytochrome oxidase 2H

How many ATP molecules may the chemical bond energy in FAD 2H produce? 4400496

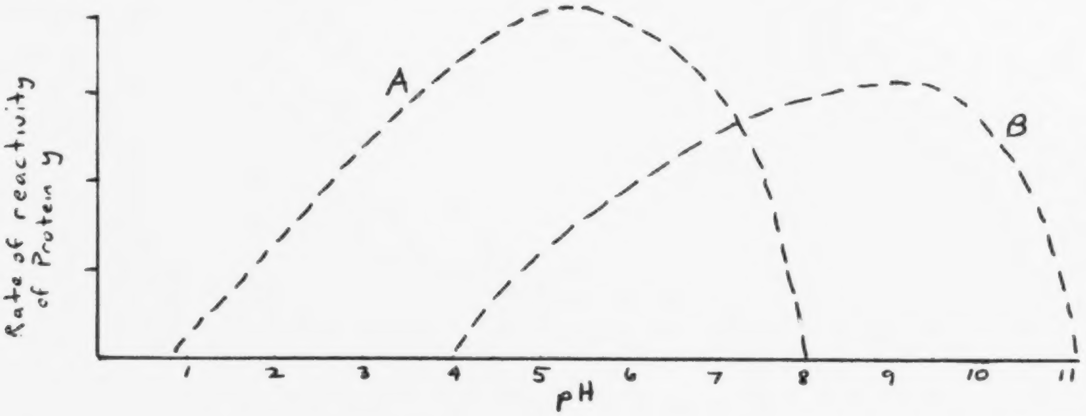
a. none
b. 1
*c. 2
d. 3
e. 4

The reaction illustrated above occurs in what part of the cell? 4400497

a. ribosome
b. endoplasmic reticulum
c. pyrenoid
*d. mitochondria
e. golgi apparatus

ENZYMES

THE STUDENT CAN INTERPRET DATA IN GRAPH FORM RELATED TO THE RATES OF REACTIVITY OF ENZYMES AND SELECT AT WHAT CONDITIONS GIVEN MAXIMA AND MINIMA MIGHT OCCUR. 163



Enzyme A has optimium effiency 4400474

*a. at a pH of 5
b. in an acid pH
c. in a basic pH
d. at a pH of 6.5
e. at a pH of 8

According to the graph the maximum amount of protein y will be attacked and converted to a product at a pH of 4400475

a. 5
b. 9
*c. 6.5
d. 11
e. 14

Activity involving both enzyme A and B would be lowest at a pH of 4400476

a. 3
b. 5
c. 8
d. 9
*e. 11

THE STUDENT CAN ANALYZE THE RELATIONSHIPS BETWEEN ENZYMES, SUBSTRATES AND THEIR PRODUCTS AND DETERMINE WHAT EFFECT EACH HAS ON THE OTHERS. 164

$$E + S \rightarrow ES\ \text{complex} \rightarrow E + P$$

The addition of enzyme to the system would 4400477

a. tend to shift the equilibrium to the left.
b. have no effect on the reaction.
c. increase the total amount of product produced.
*d. increase the rate at which the product is produced but not increase the total amount of product.
e. increase the rate of the reaction to the right and increase the amount of product produced.

If the product is allowed to build up the effect will be to 4400478

*a. slow the rate of the reaction to the right.
b. slow the rate of the reaction to the left.
c. increase the amount of enzyme substrate complex.
d. have no effect on the rate of the reaction.
e. cause a reversal of the chemical reaction so that more substrate is produced.

Source: Biology Teachers Handbook, J. J. Schwab, Wiley, 1964, pp. 366-368.

GENETICS

THE STUDENT CAN ANALYZE DATA CONCERNING BLOOD GENETICS AND SELECT PARENTAL MATING TYPES THAT WILL PRODUCE CHILDREN OF A PARTICULAR GENOTYPE. 152

During an emergency three women give birth to children in the same hospital at approximately the same time. The babies are placed in the nursery before being properly tagged. Later there is some question as to which baby belongs to which mother. The hospital checks the blood types of all parents and children and the following data is obtained:

Parents			No.	Baby
Smiths	A	B	1	O
Jones	AB	O	2	B
Olsons	A	A	3	AB

Baby 3 with blood type AB could have been produced by 4400435

*a. only the Smiths
b. only the Jones
c. only the Olsons
d. either the Smiths or the Jones
e. either the Smiths or the Olsons

Baby 2 with blood type B could have been produced by 4400436

a. only the Smiths
b. only the Jones
c. only the Olsons
*d. either the Smiths or Jones
e. either the Smiths or Olsons

It would be possible to produce an O type child 4400437

a. only from two O type parents.
b. from parents of any genotype.
*c. from parents with O, A, or B genotypes.
d. from all marriages of AB x OO parents.
e. all marriages of A and O parents.

THE STUDENT CAN ANALYZE DATA INVOLVING THE USE OF THE HARDY-WEINBERG FORMULA IN ORDER TO DETERMINE GENE FREQUENCY IN A GIVEN POPULATION. 153

Rh+ blood factor occurs in 85% of the population. This trait is controlled by a dominant gene R. 4400438

The recessive gene is designated r. Select the correct value that corresponds to the frequency of the r gene in this population.

a. .15
*b. .38
c. .85
d. .62
e. .40

A genetics instructor placed 800 fruit flies in a gallon bottle. 520 of these were wild type (V). The remainder of the flies are all vestigal wing (v) a recessive trait. Fifty flies, twenty of which were wild type escaped from the jar one day. 4400439

What was the frequency of vestigal individuals in the population before any flies escaped?

*a. .35
b. .59
c. .65
d. .41
e. .30

What is the frequency of the V gene in the population prior to the escape of the 50 flies? 4400440

a. .35
b. .59
c. .65
*d. .41
e. .30

How many individuals would you expect to be hybrid in the original population? 4400441

*a. 384
b. 400
c. None
d. 296

What was the frequency of vestigal genes in the population after making adjustments for the escape of 50 flies? 4400442

a. .67
b. .35
c. .59
d. .59
*e. .33

THE STUDENT CAN APPLY THE PRINCIPLES OF MENDELIAN GENETICS TO THE SOLVING OF WORD PROBLEMS INVOLVING DOMINANCE. 154

Directions: In corn plants purple (P) seed coat is dominant to yellow (p) seed coat and starchy (S) (wrinkled seed coat) is dominant to sugar (s) (smooth seed coat). Select from the list of crosses below the one correct response that will give the results required.

A PPSS x PPSS
B PpSs x PpSs
C PPSS x ppss
D ppss x ppss
E PPSS x ppss

B A 9:3:3:1 phenotypic ratio is produced by this cross. 4400443

C A test or backcross would be represented by this cross. 4400444

D This cross will produce only purebred recessive individuals. 4400445

C This cross will produce equal numbers of purple starchy and yellow smooth kernels of corn. 4400446

THE STUDENT CAN APPLY THE PRINCIPLES OF MENDELIAN GENETICS TO THE SOLVING OF WORD PROBLEMS INVOLVING SEX LINKAGE. 155

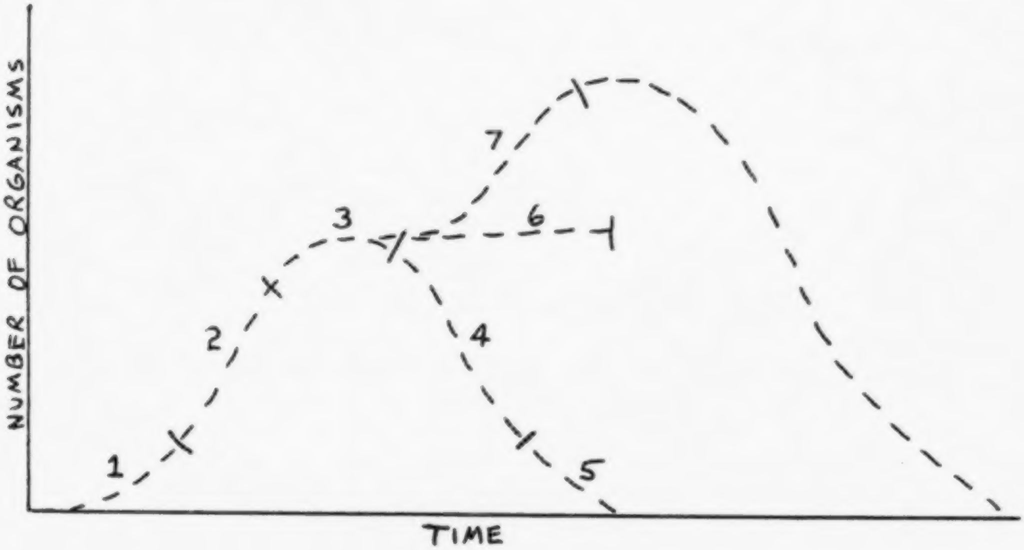
A man who has a father with hemophilia but is normal himself marries a woman who has no history of hemophilia in her family. The children produced by this marriage will be 4400447

a. boys hemophilacs, girls carriers
*b. boys normal, girls carriers
c. all normal
d. all hemophiliacs
e. all carriers

If a girl from the marriage above marries a boy who is a normal the children will be 4400448

a. all normal
b. girls normal and boys hemophiliac
c. all hemophiliacs
*d. girls carriers and boys hemophiliacs
e. all carriers

THE STUDENT CAN ANALYZE THE UNIVERSAL GROWTH CURVE BY SELECTING CORRECT DESCRIPTIONS RELATED TO IT. 156



The figure above represents a normal growth curve.

The log phase is identified by 4400449

a. 1
*b. 2
c. 3
d. 4
e. 5

A steady state situation is best represented by 4400450

a. 2
b. 4
c. 5
*d. 6
e. 7

The line that best represents what will happen to a closed system such as a bacterial culture is 4400451

a. 1,2,3,6
b. 1,2,3,4
c. 1,2,3,7
d. 1,2,3
*e. 1,2,3,4,5

The birth rate is equal to the death rate 4400452

a. 1
b. 2
*c. 3
d. 4
e. 5

Select the factor in the list below that is least likely to influence line 4 downward 4400453

a. Decrease in food supply
b. Crowding
c. Increase in amount of waste material
*d. Higher birth rate
e. Higher death rate

Select the factor in the list below that is least likely to influence the upward trend of line 7 in a positive fashion. 4400454

a. Increase in food supply
b. Removal of waste material
c. Increase in size of culture container
*d. Decrease in size of culture container
e. Higher birthrate

THE STUDENT CAN ANALYZE WORD PROBLEMS INVOLVING LINKAGE AND CROSSING OVER BY I DENTIFYING THE LOCATION OF GENES ON A GIVEN CHROMOSOME. 157

If the percentage of recombinations of Ab and aB is 8 percent, of Ac and aC is 4 percent, and of Bc and bC is 12 percent, what can be said about the positions on the chromosome of these three gene pairs with respect to one another? 4400455

*a. CAB
b. ABC
c. BCA
d. CBA
e. ACB

Suppose that in an individual heterozygous for Aa, Bb, and Cc crossing-over between genes A and B, in a pair of homologous chromosomes is 20%, and between A and C is 8%, how often would you expect crossing-over betweem B and C? 4400456

a. 12%
b. 28%
c. 40%
*d. either 12% or 28%
e. either 28% or 40%

THE STUDENT CAN DEMONSTRATE HIS ABILITY TO APPLY THE LAWS OF PROBABILITY AS THEY RELATE TO THE SCIENCE OF GENETICS BY CALCULATING THE PROBABILITY OF GIVEN CHARACTERISTICS. 158

The probability of being RH + is .85 and the probability of being male is .50. The following are the percentages for the ABO blood group.

A -40, B - 12, O - .45 AB - .03

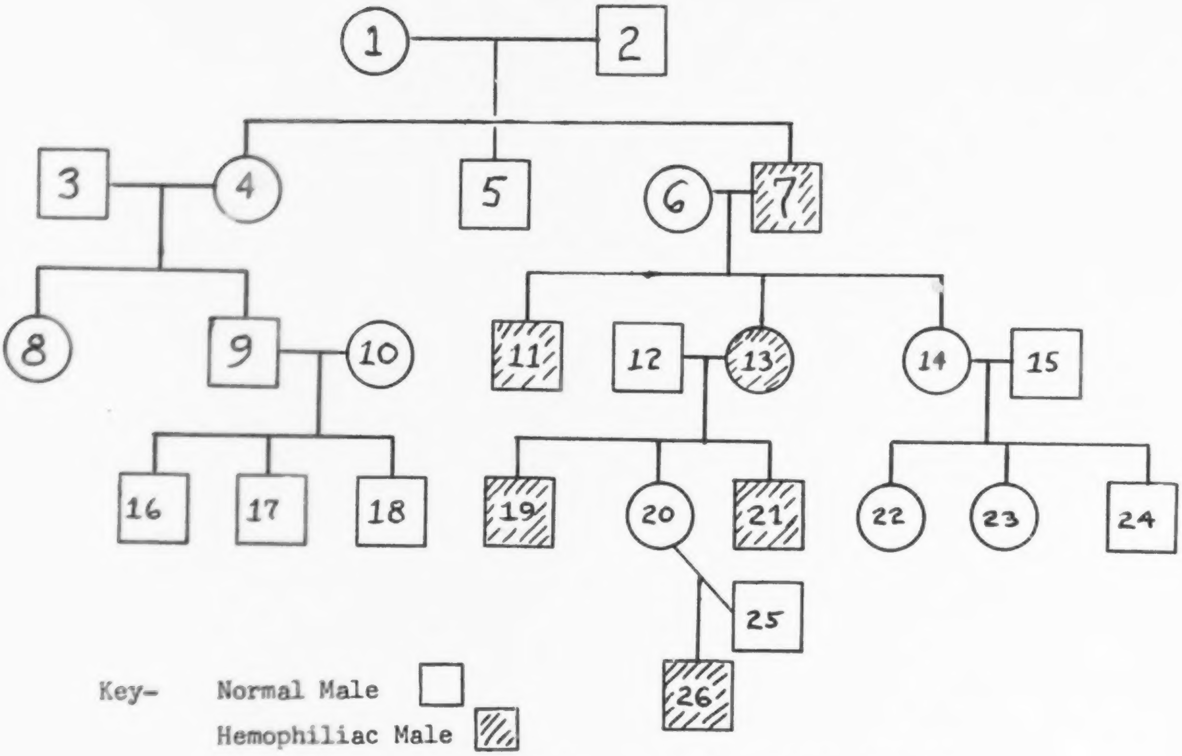
What is the probability of being an RH^{-}, O, man? 4400457

a. .25
b. .30
*c. .03
d. .003
e. .01

The probability of being A, RH^{-}, is 4400458

*a. .06
b. .006
c. .34
d. .034
e. .01

THE STUDENT CAN ANALYZE A PEDIGREE CHART WITH A LIMITED AMOUNT OF INFORMATION GIVEN, BY DETERMINING GENOTYPES AND PHENOTYPES OF SELECTED INDIVIDUALS AND THE RELATIVE PROBABILITY OF THOSE GENOTYPES THAT MIGHT BE UNCERTAIN. 159


1
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Key- Normal Male ☐

Hemophiliac Male ▨

H represents the gene for normally clotting blood

h represents the gene for hemophilia

The genotype of male number 5 is 4400459

a. X^HX^H
b. X^HX^h
c. X^hX^h
*d. X^HY
e. X^hY

Female number 6 is considered to be a 4400460

a. dominant individual
b. normal individual
c. phenotypicly neutral individual
*d. carrier
e. a hemophiliac

The genotype of female number 1 is 4400461

a. X^HX^H

*b. X^HX^h

c. X^hX^h

d. X^HY

e. X^hY

The probability that male offsprings of female number 14 and male number 15 will be X^HY is: 4400462

a. 100%
b. zero
*c. 50%
d. 75%
e. 66%

Female number 10 and male number 9 cannot produce a hemophiliac child since: 4400463

a. mothers pass the disease on only to their sons
*b. the parents carry only normal genes for blood factors
c. hemophilia is a mutant occuring infrequently
d. hemophilia is observed to skip a generation
e. fathers can never give the disease to their sons

The genotype of male number 11 is: 4400464

a. X^hX^h

b. X^HX^h

c. X^HX^H

d. X^HY

*e. X^hY

Female number 13 must have hemophilia because 4400465

a. her father gave her a gene for hemophilia.
b. her daughter number 20 produces a son who is a hemophiliac.
*c. both parents gave her X chromosones containing a gene for hemophilia.
d. her two sons are both hemophiliacs.

THE STUDENT CAN APPLY THE BINOMIAL THEOREM TO THE PROBLEM OF DETERMINING THE PROBABILITY OF PRODUCING DIFFERENT COMBINATIONS OF BOY AND GIRL OFFSPRING BY PREDICTING HIS PROBABILITY IN FAMILIES OF VARYING SIZES. 160

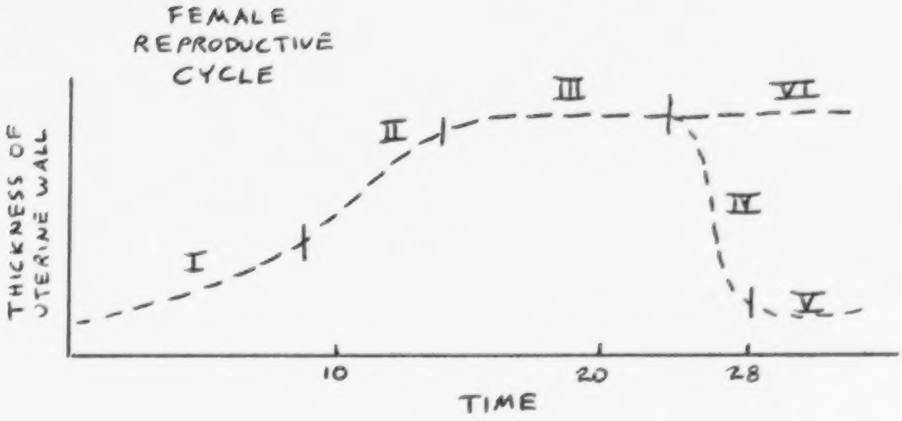
In a family of 5 offspring what is the probability of having 3 girls and 2 boys, in any order? 4400466

*a. 5 out of 32 cases
b. 10 out of 32 cases
c. 9 out of 64 cases
d. 18 out of 32 cases
e. 18 out of 64 cases

In a family of six offspring what is the probability of having 3 girls and 3 boys, in any order? 4400467

a. 9 out of 64 cases
*b. 15 out of 64 cases
c. 20 out of 64 cases
d. 25 out of 64 cases
e. 6 out of 64 cases

THE STUDENT CAN ANALYZE THE RELATIONSHIPS BETWEEN THE PITUITARY HORMONES, THE OVARIAN HORMONES AND THEIR EFFECTS ON THE DEVELOPMENT OF THE UTERUS BY IDENTIFYING PORTIONS OF THE GRAPH THAT CORRESPOND TO THESE RELATIONSHIPS. 161



The uterus would be most receptive to the implantation of a fertile egg 4400468

a. at day 10
b. at day 15
c. at day 20
d. between day 10 and day 15
*e. between day 15 and day 20

The ovary would produce large amounts of estrogen during the phase illustrated by the portion of the graph numbered: 4400469

*a. I
b. III
c. IV
d. V
e. VI

The ovary would produce large amounts of progesterone and decreasing amounts of estrogen during the phase illustrated by the portion of the graph numbered 4400470

a. I
b. II
*c. III
d. V
e. VI

The pituitary gland would produce follicle stimulating hormone during the phase illustrated by the portion of the graph numbered 4400471

a. I
b. II
c. IV
d. III
*e. V

The production of progesterone which is originally the function of the corpus luteum is taken over by the placenta. The corresponding stage in uterine development would be 4400472

a. I
b. III
c. IV
d. V
*e. VI

Source: BSCS Yellow, Chapter 26, p. 490.

THE STUDENT CAN ANALYZE THE RELATIONSHIPS BETWEEN DNA, MRNA, AND TRNA AND SELECT THE LOGICAL INTERRELATIONSHIPS BETWEEN THEM. 165

A small strand of DNA has the base sequence AAA. This will act as a template to produce mRNA that has the sequence 4400479

*a. UUU
b. CCC
c. TTT
d. AAA
e. GGG

If a strand of DNA has the sequence ATG its complimentary strand will be 4400480

a. ATG
*b. TAC
c. CAT
d. GGU
e. UAC

A strand of DNA has the sequence AAA. The tRNA that would associate with the mRNA produced by this DNA would have the sequence 4400481

a. GGG
b. UUU
c. CCC
d. TTT
*e. AAA

MICROSCOPE

THE STUDENT CAN SHOW HIS UNDERSTANDING OF THE FACTORS INFLUENCING MAGNIFICATION AND LIGHT INTENSITY INVOLVING A COMPOUND MICROSCOPE BY IDENTIFYING THE POWER, FIELD OF VISION, OR LIGHT INTENSITY FOR A GIVEN MICROSCOPE. 167

Directions: Given a compound microscope with the following lens system. An eye piece of 10 x and objectives of:

4x	scanning
10x	low power
43x	high power
97x	oil immersion

The magnification of a object viewed under high power on the above microscope would be 4400484

a. 43x
b. 4.3x
*c. 430x
d. 4300x
e. 970x

If the diameter of the field of vision under 10x was 2000u, the diameter of the field of vision under 43x would be 4400485

a. exactly 1000u
b. exactly 500u
c. 4000u
d. exactly 250u
*e. less than 1000u

If the light source in the microscope remains constant the ligh t intensity at 97x compared to 10x will be 4400486

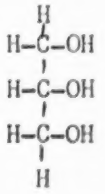
a. the same
*b. less
c. more

ORGANIC COMPOUNDS

THE STUDENT CAN COMPREHEND THE STRUCTURE FORMULA FOR COMMON ORGANIC COMPOUNDS AND RADICALS THAT ARE OF BIOLOGICAL SIGNIFICANCE AND CAN IDENTIFY THEIR NAMES AND FUNCTION. 168

Directions: Use the following twelve diagrams to answer the next six questions.

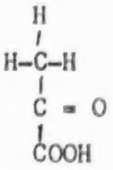
1



$$\begin{array}{c} H \\ | \\ H-C-OH \\ | \\ H-C-OH \\ | \\ H-C-OH \\ | \\ H \end{array}$$

glycerol

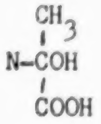
2



$$\begin{array}{c} H \\ | \\ H-C-H \\ | \\ C=O \\ | \\ COOH \end{array}$$

pyruvic acid

3



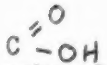
$$\begin{array}{c} CH_3 \\ | \\ N-COH \\ | \\ COOH \end{array}$$

lactic acid

4 $C = O$

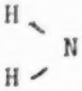
ketone

5



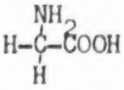
carboxyl

6



amino

7



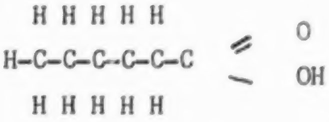
$$\begin{array}{c} NH_2 \\ | \\ H-C-COOH \\ | \\ H \end{array}$$

glycine

8 OH

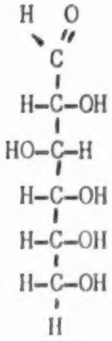
hydroxyl

9



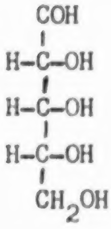
fatty acid

10



glucose

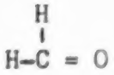
11



$$\begin{array}{c} COH \\ | \\ H-C-OH \\ | \\ H-C-OH \\ | \\ H-C-OH \\ | \\ CH_2OH \end{array}$$

ribose

12



$$\begin{array}{c} H \\ | \\ H-C=O \end{array}$$

The formula above that is an amino acid is: 4400487

a. 1
b. 2
c. 3
*d. 7
e. 11

The chemical formula that represents a saturated hydro carbon is: 4400488

a. 11
b. 10
*c. 9
d. 7
e. 1

A representative fatty acid might be 4400489

a. 11
b. 10
*c. 9
d. 7
e. 1

The acid portion of an amino acid: 4400490

a. 6
b. 4
*c. 5
d. 8
e. 12

The ion that tends to make a solution basic 4400491

a. 12
*b. 8
c. 7
d. 4
e. 5

The alcohol that joins with 3 fatty acids to form a liquid 4400492

*a. 1
b. 2
c. 3
d. 11
e. 12

PHOTOSYNTHESIS

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF PHOTOSYNTHESIS BY CORRECTLY IDENTIFYING THE PROCESS OF PHOTOSYNTHESIS OCCURRING IN NATURE FROM A NUMBER OF OTHER PROCESSES WHICH MAY OR MAY NOT BE ACCOUNTABLE. 114

While walking through the woods one warm, sunny, summer day you came across a small stagnant pond. Near one edge in a sunny spot is a mass of slimy greenish-yellow algae. You observe that bubbles of gas are in the process of being formed and released from the algae in the mass.

By applying your knowledge of plant biochemistry you attribute the formation of the gas to: 4400275

a. Algal respiration
b. Organic decomposition
*c. Algal photosynthesis
d. Anerobic bacterial action
e. Algal fermentation

Source: Modern Biology, Moon, Mann, and Towele, 1960.

PLANT FUNCTION AND STRUCTURE

THE STUDENT WILL APPLY THE PRINCIPLE OF POLLINATION AND HEREDITY BY PREDICTING AND SELECTING FROM A LIST WHAT CHARACTERISTICS THE PROGENY OF PLANTS WOULD POSSESS IF SELF-POLLINATED. 117

While on an outing a friend of yours notices a tree with 2 different kinds of flowers and later a tree with only one kind of flower. He is puzzled and asks you to explain this phenomenon. You now have the opportunity to apply some of the principles of pollination and heredity.

From the list below, select the correct reason why most plants avoid self-pollination: 4400278

a. Self-pollination leads to bizarre shapes in leaves, branches, etc.
b. Self-pollinated plants degenerate after a few generations of in-breeding.
c. Self-pollination produces an insufficient number of seeds to propagate the species.
d. Self-pollinated plants are generally smaller and lack sturdiness of stem, etc.
*e. Self-pollination produces poorer seeds, consequently inferior plants.

Source: Modern Biology, Moon, Otto and Lowle, 1960, pgs. 204, 637-8.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF PLANT FUNCTION AND STRUCTURE BY SELECTING AN EXPLANATION FOR AN OCCURANCE IN A PRACTICAL GARDENING SITUATION. 119

While working your garden one summer morning, you decide to transplant a mature Marigold plant to a new location. Later, in the heat of the day, you notice that the plant is lying on its side and is badly wilted. In the evening, you water the plant; the next morning, it is back to normal.

Apply your knowledge of plant physiology and select the best reason below which best explains why the plant wilted. 4400280

a. The plant went into a state of shock. Nothing can be done to prevent wilting.
b. It was the wrong time of the year to transplant. Plants transferred in spring and fall do not wilt.
*c. Shock, dehydration, high temperature and exposure of roots caused the wilting.
d. You failed to water the plant and to adequately fertilize the ground before transplanting.

Source: Modern Biology, Moon, Otto, Towle, 1960, p. 194.

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF THE PRINCIPLES OF SUCCESSFUL PLANT TRANSPLANTS BY SELECTING THE MOST IMPORTANT PRINCIPLE WHICH WILL CONTRIBUTE TO THE SURVIVAL OF THE PLANT FROM A LIST OF RELATED FACTORS. 120

Of the following, which is most vital in insuring transplants that are successful? 4400281

a. Watering adequately
b. Shading from the rays of the sun
c. Time of year — Fall and Spring
*d. Prevention of root disturbance
e. Using a balanced fertilizer

Source: Modern Biology, Moon, Otto, Towle, 1960, p. 194.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF LEAF STRUCTURE AND FUNCTION BY IDENTIFYING THE STRUCTURE OR FUNCTION THAT CORRELATES TO IT IN A HYPOTHETICAL SITUATION. 121

A factory is a complex of departments designed to produce a TV set, rug, or car, for example. On a field trip to a factory, you are impressed with the number of departments when suddenly the thought comes to you that the leaves you studied a few weeks ago had departments similar to that of a factory.

Following are a number of these leaf departments numbered 1 to 9, and five factory departments A to E. Place the number of the leaf department, or function, which is associated with the factory department in the space provided.

1. cells of palisade layer and spongy region.
2. CO_2, soil, water.
3. sunlight
4. glucose
5. ducts, sieve tubes, pith rays

1 A. Work rooms. 4400282

5 B. Power. 4400283

2 C. Raw materials. 4400284

8 D. Transportation Department. 4400285

6 E. Product. 4400286

Source: Modern Biology, Moon, Otto & Towle, 1960, pp. 185, 192.

PLASMOLYSIS

THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF PLASMOLYSIS WHEN GIVEN THE DEFINITION OF PLASMOLYSIS, BY SELECTING IT FROM A LIST OF FIVE TERMS. 124

When plant cells lose water causing collapse of the protoplasm, the process is known as: 4400294

a. transpiration
b. Guttation
c. Translocation
*d. Plasmolysis
e. Evaporation

Source: Modern Biology, Moon, Mann, and Towele, 1960.

PROBLEM SOLVING

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO DESIGN AN EXPERIMENT THAT WILL TEST AN ASSUMPTION OR HYPOTHESIS BY EXPLAINING THE PROCEDURE AND INTERPRETING THE EXPERIMENTAL RESULTS. 122

The hypothesis is made that "the rate or amount of water lost or retained by a plant through the process of transpiration is controlled by changes in the size of the lumen of leaf stomata."

You are requested to test this hypothesis by designing an experiment that will substantiate the hypothesis. Your experiment should include some or all of the following features:

A list of all materials and equipment. 4400287

Procedure for testing the hypothesis. 4400288

Illustrations showing the experimental design. 4400289

Observations - what actually happened. 4400290

Interpretation - reasons for success or failure - variables. 4400291

Conclusion - was the hypothesis true or false. 4400292

THE STUDENT WILL ANALYZE A GIVEN SET OF HYPOTHESES RELATIVE TO A BIOLOGICAL PROCESS AND SELECT THE ELEMENT OF AN EXPERIMENT THAT CORRELATES TO THE CORRECT HYPOTHESIS. 123

A piece of dried fruit is placed in pure water and the results observed. This experiment is designed to test which of the following hypotheses. (Circle the number preceding the most likely hypothesis.) 4400293

*a. In osmosis water passes through a semi-permeable membrane from an area of high concentration of water to an area of low concentration of water.
b. Dried fruits swell up when placed in water because the water initiates chemical activity which causes the enlargement.
c. Solutes often cross membranes and enter cells because their tension or pressure on one side of the cell wall is greater than the other.
d. The skin on fruit acts selectively and allows only solute to pass through.

THE STUDENT CAN ANALYZE THE VARIABLE INVOLVED IN THE CONSTRUCTION OF AN EXPERIMENTAL PROCEDURE AND DETERMINE WHICH ARE DEPENDANT AND INDEPENDANT VARIABLES. 162

A scientist was interested in the conditions under which seeds would best germinate. Several grains of corn were placed on moist blotting paper in each of two glass dishes. One dish was placed in a dark room the other in a well lighted room. Temperature was maintained at the same level in each room. After 4 days all the seeds in both dishes had germinated. Select the interpretation of the data that best explains what happened. 4400473

a. Seeds germinate when a warm temperature is maintained.
b. Seeds germinate when they are given adequate water.
c. The size of the seed container has no effect on seed germination.
*d. The experimenter was attempting to determine the effect of light on seed germination.
e. Seeds may germinate on moist blotting paper.

REPRODUCTION

THE STUDENT WILL RECALL THE BASIC BIOLOGICAL PRINCIPLES INVOLVING CELLULAR CHANGES DURING SPERMATOGENESIS AND OOGONIA BY EXAMPLES OF HAPLOID AND DIPLOID STRUCTURES. 105

In sexual reproduction, the number of chromosomes during certain phases of meiosis will be 1N or 2N. Which of the following reproductive structures contains 1N number of chromosomes? 4400238

a. zygote
b. synergid
c. sorus
d. somatic cell
*e. ovum

Source: Modern Biology, Moon, Mann, and Towel, 1960.
High School Biology - BSCS, Green version, 1966, Chap.on Reproduction.

THE STUDENT WILL DEMONSTRATE A KNOWLEDGE OF THE PROCESS INVOLVED WHEN A CHANGE OCCURS IN HAPLOID AND DIPLOID NUMBER DURING SPERMATOGENESIS AND OOGONIA BY SELECTING THE CORRECT PROCESS FROM A LIST OF ALTERNATIVES. 106

The process of changing chromosomal number from 2N to 1N is known as 4400239

a. fission
b. symbiosis
*c. meiosis
d. fusion
e. mitosis

Source: High School Biology - BSCS, Green version, 1966, Chap. on Reproduction.

THE STUDENT WILL BE ABLE TO IDENTIFY THE CONCEPT OF REPRODUCTION BY DISTINGUISHING A CONCLUSION WHICH IS UNIVERSALLY TRUE FROM ONES THAT ARE NOT TRUE. 107

Normally reproduction is thought of as a process involving an increase in population; however, when two unicellular organisms fuse to become one there is a decrease in population. In view of this paradox, which of the following is the best definition of reproduction? 4400240

a. The sexual process is a reproduction process involving only 1 individual.
b. Reproduction is a process involving binar fission.
*c. Reproduction is a process by which new individuals are formed.
d. Reproduction occurs when organisms unite to produce.

Source: Modern Biology, Moon, Mann, and Towele, 1960.
High School Biology - BSCS, Green version, 1966, Chap. on Reproduction.

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE DIFFERENT TYPES OF REPRODUCTION BY IDENTIFYING EXAMPLES AS SEXUAL, ASEXUAL OR A COMBINATION OF BOTH. 108

Directions: The reproductive process may be divided into two general classes - sexual and asexual. For convenience these have been subdivided into 2 main categories and a third category which is a combination of the first two.

Types of Reproduction:

I - Asexual
    A - Reproduction by spores
    B - Vegetative reproduction

II - Sexual
    C - Fertilization by egg and sperm
    D - Parthenogenesis

III - Combination of asexual and sexual
    E - Both B and C
    F - Both A and C

Place the letter preceding one of the 6 types of reproduction above on the blank space preceding the number of the specific example listed below, which illustrates the type of reproduction. Examples of types of reproduction.

B Reproduction by budding in sponges. 4400241

B Planting banana stems (cuttings) to produce new plants. 4400242

C Pollination of a pear or apple tree. 4400243

D Females producing eggs which hatch into females. 4400244

B Tips of raspberry plants form new roots. 4400245

B Grafting a scion to a stock. 4400246

E Reproduction in coelenterates. (Hydra) 4400247

B Yeast cell reproduction. 4400248

B A star fish ray grows into a new star fish. 4400249

D Reproduction among aphids and rotifers. 4400250

B Fission in paramecium. 4400251

C Reproduction involving a zygote. 4400253

C Fusion of male and female gametes. 4400254

A Reproduction of bread mold (Rizopus). 4400255

B Annelids reproducing by fragmentation. 4400256

Source: Modern Biology, Moon, Mann, and Towele, 1960.
High School Biology - BSCS, Green version, 1966, Chap. on Reproduction.

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE ORDER OF PHASES OF ALTERNATION OF GENERATION BY IDENTIFYING A CORRECT LISTING, IN ORDER, OF FOUR SUCH PHASES. 109

Directions: Alternation of generation occurs among plants and animals. Below are listed four stages in the life cycle of a moss plant. From each, select the alternative that is in correct sequence.

a. Egg & Sperm - Gametophyte - Zygote - Antheridium & Archegonium. 4400257
b. Antheridium & Archegonium - Gametophyte - Zygote - Egg & Sperm.
*c. Gametophyte - Antheridium & Archegonium - Egg & Sperm - Zygote.
d. Egg & Sperm - Antheridium & Archegonium - Gametophyte - Zygote.
e. Zygote - Gametophyte - Egg & Sperm - Antheridium & Archegonium.

a. Spore - Sporophyte - Germinating Spore - Gametophyte. 4400258
b. Sporophyte - Spore - Gametophyte - Germinating Spore.
c. Sporophyte - Germinating Spore - Spore - Gametophyte.
d. Gametophyte - Germinating Spore - Spore - Sporophyte.
*e. Sporophyte - Spore - Germinating Spore - Gametophyte.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF FERTILIZATION BY SELECTING THE CORRECT METHOD OF FERTILIZATION USED BY PLANTS FROM A LIST OF DIFFERENT METHODS. 110

In the sexual reproduction phase of the moss plant the antheridium produces the sperm cell; and the archegonium produces the ovum. Inasmuch as these structures are on separate plants, for fertilization to occur the sperm must find and fertilize the egg. Of the explanations below which method is used by the moss plant? 4400259

a. As in pollination, an insect carries the sperm and inadvertently places it on the ovum.
*b. During wet weather the sperm swims in a film of water until it finds the ovum.
c. The wind carries the sperm to the archegonium.
d. Fertilization is similar to that found in the yucca plant - a specific species of insect carries the sperm to the egg.
e. Fertilization is a matter of chance; however, if it doesn't occur, the process of parthenogenesis takes place.

Source: Modern Biology, Moon, Mann, and Towele, 1960.
High School Biology - BSCS, Green version, 1966, Chap. on Reproduction.

THE STUDENT IS ABLE TO IDENTIFY THE NAMES OF PLANT REPRODUCTIVE STRUCTURES BY MATCHING THE NAMES TO DESCRIPTIONS, FUNCTIONS OR CORRECT ORDER FROM A LIST OF FIVE SUCH PHASES. 111

As a Boy Scout Leader, you plan to quiz your unit on the principles of reproduction in plants, particularly stressing the items in the key. You decide to prepare a list of statements related to one or more of the keyed items. Then you decide to make up an answer key. Do this now by placing the letter preceding the keyed item, on the answer blank in front of the statement to which the key item is related.

Key:
A - pistil
B - stamen
C - megaspore
D - pollen
E - microspore

A A structure containing one or more female gametocytes. 4400260

D The male part of a plant that carries a generative and tube nucleus. 4400261

E In one sense this may be considered the male half of a new plant. 4400262

B This structure analogous to the antherodium of a moss plant produces the sperm. 4400263

A A structure which, if fertilized, becomes the fruit of the plant. 4400264

C This structure is also called the ovum of female gametophyte. 4400265

B A structure containing filament and anther that plays a role in sperm production. 4400266

D Insects, wind, and man play a vital role in the dissemination of this structure. 4400267

C Eventually, if fertilized, this part will develop into a seed. 4400268

E This structure, found in the pollen grain, is another name for a sperm cell. 4400269

Source: Modern Biology, Moon, Mann, and Towele, 1960.
High School Biology - BSCS, Green version, 1966, Chap. on Reproduction.

THE STUDENT WILL BE ABLE TO RECOGNIZE THE CORRECT SEQUENCE OF CHROMOSOMAL CHANGES OCCURRING DURING MEIOSIS BY SELECTING THE CORRECT ORDER FROM A LIST OF FIVE SUCH PHASES. 112

During the process of meiosis certain chromosomal divisions take place in the development of egg and sperm. Select the item below which correctly illustrates the changes that occur. (N = No. of chromosomes) 4400270

a. 1N to 2N to 3N
b. 1N to 4N to 2N
c. 1N to 1N to 1N
d. 2N to 2N to 2N
*e. 2N to 4N to 1N

Source: Modern Biology, Moon, and Towle, 1960.
High School Biology - BSCS, Green version, 1966, Chap. on Reproduction.

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF PLANT REPRODUCTION BY COMPLETING PARTIAL STATEMENTS (OR QUESTIONS). 113

Directions: From your understanding of plant reproduction select the best answer from the 5 options given for each statement below:

Seeds will not develop in the Yucca plant unless — 4400271

a. the wind is blowing in the right direction for pollination.
b. there is plenty of water and soil nutrient present to produce flowers.
c. male and female plants are in the vicinity.
*d. a specific pollinating agent, such as an insect, is present.
e. the pollen capsule opens in time to fertilize the pistil.

Berries do not develop on holly trees unless — 4400272

a. the plants are adequately fertilized to produce required hormones.
b. the soil has excellent drainage yet plenty of water to promote good growth.
c. two monecious holly trees are planted together.
*d. a staminate and pistillate holly tree are near each other.
e. the tree is over 5 or 6 years old.

In 1839 a single individual of the plant Alchomea ilicifolia, bearing only pistillate flowers, produced abundant seed in the Kew Gardens, near London. The nearest male plant of the species was in Australia. What is the most logical reason for this occurrance? 4400273

a. When a plant is not fertilized by natural means certain hormones develop and produce the seeds.
b. It is a characteristic of some plants to produce seeds spontaneously at definite intervals.
*c. Wind born pollen from Australia fertilized the plant.
d. An instant or chemical factor stimulated seed production.
e. When natural pollination does not occur, most plants to preserve the species will produce seeds before they die.

Some flowers open at night because 4400274

a. the biological time clock controlling blossoming is out of place because requirements of photopecodism had not met.
b. It is much cooler at night and wilting does not occur.
c. At night leaves, roots, and stems are inactive, therefore stored energy may be used for flower production.
*d. Some insects which pollinate these particular plants fly only at night.
e. At night there is more wind to effectively pollinate these plants.

Source: Modern Biology, Moon, Mann, and Towele, 1960.
High School Biology - BSCS, Green version, 1966, Chap. on Reproduction.

THE STUDENT WILL APPLY THE MATHEMATICAL CONCEPT OF RATIO OF SURFACE AREA TO VOLUME TO EXPLAIN THE CONCEPT OF REPRODUCTION IN SINGLE CELLED ORGANISMS BY SELECTING FROM A NUMBER OF STATEMENTS THE ONE THAT EXPLAINS WHY THESE ORGANISMS REMAIN MICROSCOPIC IN SIZE. 118

In your mathematics class you learned that there is a definite ratio between the surface area of a cube and its volume. You also have learned that as the cube increases in size, the increase in volume is greater than the increase in surface area.

If applicable, apply this principle to the study of reproduction in single celled organisms. These forms reproduce by fission and remain microscopic in size. Why don't they continue to grow and reach the size of a hen's egg or a horse?

From the options below select the best reason why these minute forms do not grow beyond a certain size? 4400279

a. Laws of heredity control the size of the organism — surface area and volume are irrelevant.
b. As size increases, a built-in biological timeclock determines when fission occurs, thus size is controlled.
*c. As the size of the cell increases the volume of "in-going and out-going" products cannot be handled properly by the cell membrane.
d. As cell volume increases the plasma membrand becomes stretched — thus stretching acts as a stimulus for fission to gegin.
e. As cell size increases the openings in the cell wall become modified to adequately compensate for the change in surface area and volume, therefore, surface area and cell volume are irrelevant.

DRUGS

GIVEN THE CHARACTERISTICS OF A NARCOTIC, THE STUDENT CAN IDENTIFY THE DRUG WHICH PRODUCES HALLUCINOGENIC REACTIONS FROM A LIST OF ALTERNATIVES. 286

First produced in 1938, doses as low as 25 micrograms were found to be active, odorless, colorless, tasteless, and produced possible chromosome damage. Its manufacture was outlawed. This description fits: 4400735

*a. Lysergic acid diethylamide (LSD)
B. Psilocybin
c. Peyote
d. Dimethyl tryptamine (DMT)

This drug was first used by primitives for certain spiritual communion with the supernatural. It comes from the Mexican Mushroom, ingested orally, and its effects are close to those of LSD. Name the drug. 4400736

*a. Peyote
b. LSD
c. Mescaline
d. Psilocybin

AS A RESULT OF BEING ABLE TO TRANSLATE THE SLANG BY WHICH DRUGS ARE KNOWN, THE STUDENT WILL DEMONSTRATE HIS ABILITY TO ANALYZE GIVEN SITUATIONS INVOLVING DRUG ABUSE AND MAKE THE APPROPRIATE RESPONSE. 287

A boy, 16, is brought unconscious into a hospital with his life signs failing. He is a known heroin addict and suspected of being an informer. From the following, pick the most likely cause of his condition. 4400737

a. He is "stoned".
b. He is "spaced".
*c. He was given a "hot shot".
d. He is exhibiting "cold turkey" symptoms.

A girl, 15, at a party, is asked by a friend to try pills that were brought for "kicks." As a result of accepting she is 4400738

a. "hooked"
*b. being "turned on"
c. about to be "burned"
d. "turned off"

A student's locker is found to contain "a cooker," "needle," and some "buttons." What inference can be drawn from the articles found. 4400739

a. The student is a pusher.
b. The student uses horse.
c. The student uses more than horse.
*d. Not enough evidence to provide a valid conclusion.

From the following pairs of words, which pair contradicts itself. 4400740

a. Mainliner and Junkie
b. Blasted and stoned
*c. Turned off and blasted
d. Hit and blasted

A student of 18 has "crashed" after a "six day run." To stop the hallucinations he decides to pull out. What combination will he use? 4400741

a. Barbs and Meth
b. Seconal and Heroin
c. Seconal and Big C
*d. Red Devils and Hearts

Recently a 17 year old girl was given a peace pill at a party. At her inquest her boyfriend stated that the "hog" she was given was not a "hot shot". The verdict was murder because: 4400742

*a. "Hog" is used by veterinarians and not intended for human use.
b. He "gave her wings" and infected her veins.
c. "Hog" is the same as "Big C". Therefore a dangerous poison.
d. Her boyfriend was hooked at the time of the fix.

To counter the effects of "Hearts," "Dexies," and "Whites," the user will turn to: 4400743

a. Blue heavens and Bennies
b. Big C and Rainbows
c. Horse and Coke
*d. Yellow Jackets and Red Devils

When an addicts bag allows him to be blasted by drinking, eating, sniffing, and/or mainlining, the thing that turns him on is: 4400744

a. A combination of "pick-me-ups" and "Downers"
*b. Grass
c. Big C
d. Junk

The behavior of a Junkie in need of a fix can best be described as: 4400745

a. spaced
b. stoned
*c. cold turkey--violent
d. tripped out

Source: Linda Lamba Enterprises,
1029 Cynthia Ave.
Pasadena, California 91107

THE STUDENT WILL APPLY HIS KNOWLEDGE OF SLANG (NARCOTICS) BY TRANSLATING THE WORDS INTO COMMON USAGE. 288

A Junkie whose bag was smack was advised by his pusher to stop snorting and start mainlining. Translated, this statement reads: 4400746

a. A cocaine addict was told to use a hypodermic needle instead of breathing the drug.
b. An injection of speed (meth) is advised instead of taking a pill of morphine sulfate.
c. A supplier is telling his customer to stop wasting heroin.
*d. A heroin user is told by his source to stop sniffing heroin and begin shooting it in his veins.

GIVEN A SPECIFIC SITUATION, THE STUDENT WILL BE ABLE TO IDENTIFY THE VARIABLE(S) RESPONSIBLE FOR THE CONDITION BY SELECTING THEM FROM A LIST OF ALTERNATIVES. 289

At a "Pill party" one student offers his friends a chance to try some pills that his doctor prescribed for him. Which of the following would be a valid reason for refusing his offer: 4400747

a. Dose (amount used unknown)
*b. User's unique body chemistry
c. Purity of drug used
d. Potency

Complete the following sentence: 4400748
The average pusher has least knowledge of:

a. potency (strength of drug)
b. user's mood and surroundings
c. dose (amount of drug used)
*d. user's emotional stability

A physician who prescribes a drug for a patient is most sure of what factors: 4400749

*a. the drug's potency and purity
b. the dose and the user's unique body chemistry
c. the potency and the user's emotional stability
d. the purity and the user's mood and surroundings

Because of final exams or tense situations, students may take tranquilizers to sleep. Some students experience extreme depression to the point of contemplating suicide. What variable is of least importance in this situation. 4400750

*a. purity of the drug used
b. user's unique body chemistry
c. user's emotional stability
d. user's mood and surroundings

A heroin addict has purchased 12 caps. When using the drug, he finds that he needs two caps toget the same effect as one cap that he purchased from another pusher. What variable could be responsible for his experience. 4400751

a. The purity from each source is different
b. The dose is not the same
*c. The potency of the drugs is different
d. The user's body chemistry has changed

Source: Linda Lamb Enterprises

THE STUDENT IS TO DEMONSTRATE HIS KNOWLEDGE OF NARCOTICS BY INDICATING THE CHARACTERISTICS, SIDE EFFECTS, AND SOURCES (LEGAL OR ILLEGAL MFG) IN A CHART FORM PROVIDED.

4400752

Name of drug	Legally manufactured	Psychologically addictive	Psysiologically addictive	Produces withdrawal symptoms	Needs increased doses to obtain desired effect	Has some medical use	Hallucinogenic reaction
nicotine	yes	yes	no	no	no	yes-Bell's palsy	no
alcohol	yes	yes	no	no	no	yes solvent & depressant	yes in excess
LSD	no	yes	no	no	no	no	yes
barbiturates	yes	yes	yes	yes	yes	yes	no
heroin	no	yes	yes	yes	yes	no	no
oral amphetamine	yes	yes	no	no	no	yes	no
injected amphetamines	yes	yes	no	yes	no	yes	yes
marijuana	no	yes	no	no	no	no	yes

Source: Movie "LSD 25" "Marijuana 13" The Chemical Drop Out

THE STUDENT IS TO IDENTIFY THE USE OF THE FOLLOWING TESTS AS THEY APPLY TO USERS BY MAKING THE PROPER SELECTIONS FROM THE LIST PROVIDED. 291

In the following the students are to check the statements that are true of the Nalline test.

X a. Nalline is derived from opium, but it is an antidote, having a reverse action to it. 4400753

___ b. Nalline can be used to detect cocaine abuse. 4400754

X c. If the pupil of the eye dilates after Nalline is injected in the suspected user, it means that heroin has been taken within 72 hours. 4400755

X d. Addicts seem to approve of the Nalline test because it can prove that they are "clean". 4400756

X e. Nalline is considered a worthfhile adjunct in the rehabilitation of narcotic users. 4400757

Source: "Juvenile Offenders" by Vedder.

THE STUDENT IS TO RECOGNIZE THE SOURCE OF THE NARCOTIC BY IDENTIFYING THE PRODUCT FROM THE LIST PROVIDED. 292

In turkey, poppies are grown (under gov't control) to provide morphine for medical use. Which of the following abused drug is NOT derived from this source? 4400758

a. heroin
*b. cocaine
c. opium
d. codeine

North Africa is known for a narcotic which is 10 times more powerful than marijuana. Its name is 4400759

*a. hashish
b. peyote
c. mescaline
d. heroin

From the following list, the student will check the source(s) that are NOT responsible for the production of hallucinogenics (LSD, DMT, STP, etc.) 4400760

a. ergot (fungus on rye)
b. morning glory seeds
c. nutmeg
*d. coca shrub

Indicate those statements that apply to the manufacture and distribution of amphetamines and depressants.

*a. They are manufactured under strict controls 4400761
*b. They are easier to procure 4400762
c. They are available only through illicit sources 4400763
*d. Their potency is easily recognized 4400764
*e. Their source is easily identified 4400765
f. The ingredients cannot be traced 4400766

The legal importation, distribution, and sale of opiates was ended in the United States by 4400767

a. the repeal of the 18th Amendment
*b. the Harrison Act of 1914
c. the 21st Amendment
d. none of the above

Which of the following are not considered primary sources of drugs for teenagers. 4400768

a. older brothers and sisters
b. friends
c. parents who are on prescribed medications
*d. the mafia
*e. pushers on the street
f. fellow students who "push" in schools

Source: Chemical Drop Out — Blue Shield-Blue Cross, Juvenile Offenders.

GIVEN THE SIX VARIABLES OF DRUG ABUSE, THE STUDENT IS TO ANALYZE THE FOLLOWING SITUATIONS AND INDICATE BY LETTER THE MOST IMPORTANT AND THE LEAST IMPORTANT VARIABLES TO BE CONSIDERED AS THEY APPLY IN THE SPECIFIC SITUATION. 293

Directions: After reading each situation, indicate by circling the correct letter(s) those variables that apply most and those that apply least in importance.

a. dose (amount used)
b. potency (strength of drug)
c. purity of drug
d. user's mood and surroundings
e. user's emotional stability
f. user's body chemistry

Sue, a college student, is depressed because she feels that she can't continue her present course. Her parents are proud of her and expect her to do well. A roommate offers Sue some pills that the roommates' doctor had prescribed for her when she had complained of moods of depression. Consider the variables and respond. 4400769

Most Important	Least Important
~~a~~	a
b	~~b~~
c	~~c~~
~~d~~	d
~~e~~	e
~~f~~	f

Jack's rock group plays three nights a week after school until 1:30 A.M., his grades are falling because he claims that he is too nervous to study and his nights are sleepless because of worry. Bill, the lead guitarist, offers to give Jack some Red Devils to help him "calm down". Bill claims that they were purchased from a reliable source. 4400770
Evaluate the variables in this situation.

Most Important	Least Important
~~a~~	a
~~b~~	b
~~c~~	c
d	~~d~~
~~e~~	e
~~f~~	f

The "In Group" at a high school have decided to have a "Pill Party". Each participant must take 5 pills from the salad bowl and ingest them. Within 20 minutes a girl in the group has lost consciousness. Assuming all the pills were of legal manufacture, what three variables would be most important to a doctor treating her? 4400771

~~a~~
~~b~~
c
d
e
~~f~~

An overweight girl decided to use her mother's prescribed diet pills. After three days of use she found herself nervous, with moods of elation and depression, and unable to sleep. What variables had she failed to consider? 4400772

~~a~~
~~b~~
c
d
~~e~~
~~f~~

As a result of an LSD party, one boy suffered a "Freak-out". 4400773
Which of the variables is probably least responsible for his condition?

a
b
c
d
e
f

Source: Lamb Publications

GIVEN A PATIENT EXHIBITING A SET OF SYMPTOMS, THE STUDENT WILL BE ABLE TO APPLY HIS KNOWLEDGE OF THE EFFECTS OF DRUGS BY NAMING THE TYPE OF NARCOTIC BEING USED. 294

A burglary suspect is brought in after he has attempted to fence a stolen TV set, some watches, and silver. The suspect has pinpoint eye pupils, needle tracks, and a dream-like disposition. A good guess as to the reason for his condition would be 4400774

a. cocaine addition
b. the barbiturate habit
*c. heroin addiction
d. all of the above

The withdrawal symptoms of this drug are thought to be more dangerous than those of heroin. The patient's intoxication progresses from drowsy to coma and possible death. Which of the following would NOT be in this classification. 4400775

a. seconal
b. tuinal
c. amytal
*d. dexadrine

A teacher has noticed that a very quiet girl of 15 is suddenly undergoing a personality change. She seems unable to stop talking, argues continuously, eats no lunch, often exhibits confusion, has lost weight, and has changed her style of dress and behavior. A check with the school nurse confirms the fact that the firl is taking 4400776

a. red devils
*b. dexadrine
c. peyote
d. hashish

A parent notices that his boy of 16 is rebelling by arguing with him, that his boy seems to have a craving for sweets (eats two desserts at a meal), seems depressed at times, and some times the boy's mind seems to be'miles away'. The parent has recognized these symptoms as 4400777

*a. (unless proven otherwise)--normal adolescent behavior
b. taking "speed"
c. "blowing grass"
d. on nembutal

Source: The Chemical Drop Out
Blue Cross and Blue Shield
Linda Lamb, 1029 Cynthia Ave.
Pasadina, California.

GIVEN A SITUATION IN WHICH COMMON MISCONCEPTIONS ARE SOMETIMES OFFERED AS EVIDENCE TO SUPPORT POSITIONS ON DRUG ABUSE, THE STUDENT IS TO EVALUATE THE ARGUMENTS OFFERED AND TO DECIDE WHETHER OR NOT THE FACTS VINDICATE THE POSITIONS TAKEN BY SELECTING THE APPROPRIATE RESPONSE. 295

Legislation regarding the legalization of marijuana has been frustrated by those who claim that the use of "pot" is the first step toward heroin addiction. Therefore they want it classed the same as a "hard" narcotic and not as just a dangerous drug.

Directions: Indicate those arguments which support the above claim with proven fact. Check "yes" or "no"

YES	NO			
X		a.	98% of heroin addicts began by using marijuana.	4400778
	X	b.	98% of all marijuana users become heroin addicts.	4400779
	X	c.	Marijuana leads to cocaine addiction.	4400780
	X	d.	There are no statistics available to support the position taken.	4400781
	X	e.	Learning to smoke pot is a technique useful in heroin addition.	4400782
	X	f.	Both drugs are physiologically addictive.	4400783
X		g.	Both drugs can be psychologically addictive.	4400784
	X	h.	Both drugs are classed as depressants.	4400785
X		i.	Both drugs can be taken by injection.	4400786
X		j.	Both drugs can produce emotional extremes.	4400787
	X	k.	In all cases, the pot user will look for a drug with more "kick" to satisfy his needs.	4400788
	X	l.	All research shows marijuana to be less harmful than nicotine or alcohol.	4400789
	X	m.	Both drugs require increased doses to obtain desired effect.	4400790
	X	n.	Withdrawal pain (biological) is present when either drug is not available.	4400791
X		o.	In an overdose situation, both drugs are capable of producing death when injected.	4400792

Source: Drug Abuse—Chemical Drop-Out
Lamb Enterprises

It is contended that LSD is responsible for chromosome damage in the user and can cause birth defects; further that damage to the cortex of the brain produces gross emotional and personality changes.

The student will indicate by his selection his agreement of the following to the statement above.

Beyond the scope of the question.	Disagree	Agree			
	X		a.	The contentions above are proven scientific facts	4400793
		X	b.	The above is a good example of "half truth".	4400794
	X		c.	None of the above is proven fact.	4400795
	X		d.	LSD is too new to have had any research completed.	4400796
X			e.	The use of LSD can produce psychological dependence	4400797
		X	f.	The extent of mental harm due to LSD users is still being tested clinically	4400798
X			g.	The "freak out" is a very real possibility with the use of LSD	4400799
		X	h.	Chromosome damage is a proven fact	4400800
X			i.	Birth defects can be attributed to the use of LSD	4400801
	X		j.	All LSD users will suffer brain damage.	4400802

Source: Lamb Enterprises.

THE STUDENT WILL RECOGNIZE THE FACTORS IN SOCIETY THAT ARE CONDUCTIVE TO PROMOTING ILLICIT DRUG USE BY HAVING HIM ANALYZE THE SITUATION AND RESPOND BY IDENTIFYING THE FACTORS PECULIAR TO THE SITUATION. 299

Directions: You are to select the most nearly correct response in the following situations.

According to "cloward and Ohlin" there are three distinct types of Juvenile subculture. Which of the following is NOT 4400837

a. conflict subculture
b. criminal subculture
*c. advance subculture
d. retreatest subculture

Of the subcultures which best represents the "beat" attitude—that culture which supports the escape from life philosophy—rebellion to convention and tradition—that culture whose members would be most willing to engage in illicit drug experiences. 4400838

a. criminal subculture
b. advance subculture
c. conflict subculture
*d. retreatist subculture

Source: Juvenile Offenders by Vedder.

IN THE FOLLOWING SITUATIONS, THE STUDENT IS TO APPLY HIS KNOWLEDGE OF THE TEN FREQUENT INDICATIONS OF DRUG ABUSE BY CORRECTLY IDENTIFYING THE SYMPTOMS RESPONSIBLE FOR EACH (OR) THE ACTION TO BE TAKEN. 300

Sue's mother has noticed that Sue cries or laughs hysterically for seemingly no reason. Sue rebels often and has expressed abnormal ideas concerning her moral values and judgements, and her breath and body odor have become increasing bad. Which of the following have not yet been expressed as symptoms of drug abuse by Sue? 4400839

a. moral ill health
b. physical ill health
c. mental ill health
*d. fear complex

Sidney did well in school. This year, however, he seems to have lost interest in completing his education. His eating habits are erratic and he expresses a desire for water and sweets. Because of the symptoms his father should consult 4400840

a. the Juvenile officer
*b. the family doctor
c. the school nurse
d. Sidney's guidance counselor

Barbara is certain that someone is trying to kill her. She refuses to eat "because someone has poisoned the food." Even walking down the street becomes an ordeal for her because "terror is lurking in every shadow". Her friends, she believes, want to kill her. 4400841

*a. her behavior can best be described as paranoia
b. her symptoms are those of schizophrenia
c. she is suffering from unusual emotional extremes
d. she is experiencing dispositional extremes

Irving's father is concerned over his son's physical appearance. Irving has lost weight, his skin has changed color, his posture and reflexes have deteriorated. Upon investigation, the father found no needle tracks on his son and Irving's eyes seemed normal. From the above it is clear that 4400842

a. Irving's father should still be concerned enough to call for professional help
b. Irving's father is unaware of the total number of symptoms of drug abuse
c. All drugs do not change the size of the pupil of the eye
*d. all of the above are true.

Teri's schoolmates have noticed a distinct change in her personality; in fact, she goes out of her way to be argumentative. In class, she seems confused at even simple directions and often talks out loud during tests or she may begin to wander about the room. When she was asked to sit down, she began to swear and attempted to slap the teacher. Her mother claims that she is just going through a "phase". Indicate, from the list below, the best possible action to be taken. 4400843

a. Since Teri is just 16, she will "straighten out" if given time.
b. Her mother should take a course in drug abuse to help her daughter.
*c. Because time is important, the school nurse should contact Teri's doctor and enlist his aid in working with both Teri and her mother.
d. A call to the Narcotics Division is in order because Teri is abusing drugs.

Many of the ten indications of drug abuse are evidenced in a human being after his body has been subjected to the intoxicant THC (Tetrahydrocannabinol). Which of the following are true of this substance. 4400844

*a. It is found in the resin and leaves of the marijuana plant
b. The resin (powder) is known as hashish and is about 10 times stronger than leaf marijuana.
c. THC is no more dangerous than an equal amount of nicotine.
*d. THC will produce effects found in both amphetamines and barbiturates

Source: Lamb Enterprises
Chemical Drop-Out

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO DETERMINE THE EFFECTS THAT CAN BE EXPECTED BY INGESTING (OR INJECTING) TWO DRUGS SIMULTANEOUSLY BY FILLING IN A CHART WITH THE APPROPRIATE RESPONSE. (SYNERGISTIC EFFECTS). 301

4400845

	Depressant	Amphetamine	Hallucinogen	Heroin	Alcohol
Depressant	Reinforce	Probably cancel but unpredictable	Unpredictable	Coma-Death Unpredictable	Death Suicide
Amphetamine	Probably cancel but unpredictable	Reinforce reaction	Unpredictable	Unpredictable	Unpredictable
Speed	Unpredictable	Unpredictable	Unpredictable	Unpredictable	Unpredictable
Morphine	Death-Coma	Unpredictable	Unpredictable	Reinforce reaction	Reinforce, Possible death
Cocaine	Unpredictable Opposite effect	Probably reinforce reaction but unpredictable	Unpredictable	"Speedball" Schizophrenic reaction	Unpredictable

Note: The student is to fill in the chart with the current data available. Research is being conducted at this time to better limit the unpredictable factor. If it were not for the fact that young people are mixing drugs with impunity, much of this research would be unnecessary. At this point, we have no reference to even generalize the situation, hence we are forced to use the term "unpredictable."

Source: Local pharmacists

THE STUDENT IS TO RECOGNIZE PECULIAR BEHAVIOR PATTERNS AS THEY APPLY TO INDIVIDUALS WHO ABUSE SPECIFIC TYPES OF DRUGS BY BEING ABLE TO IDENTIFY THE DRUG AND THE BEHAVIOR IT PRODUCES. 303

The student will choose the behavior pattern that is most indicative of the abuse of a given drug by matching the described behavior with the drug.

D Itchy nose, general air of furtiveness, revery.

A Time seems extended, talkative, craving for sweets and liquids, wants room dark, has no fears, things seem funnier.

E Depressed, drowsy with slurred speech, withdrawal pains if dose not available, like heroin, body builds tolerance.

C Dream-like disposition, pin-point eyes, pallid complexion, "needle tracks" on arms, violent when "fix" not available.

B Promotes audio-visual hallucinations, irrational behavior, personality change may be permanent, panic is a common symptom.

G User may appear uninhibited, unable to sleep or eat, very talkative, irrational behavior. 4400855

F Acute paranoia, confused, toxic psychosis, violent behavior, sleep coma 18-48 hours. 4400856

A. Marijuana 4400850
B. LSD 4400851
C. Heroin
D. Cocaine 4400852
E. Barbiturates
F. Methamphetamine 4400853
G. Amphetamines 4400854

Source: Vedder "Juvenile Offenders".

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